A PILOT SCHOOL HEALTH SERVICE

in

SOUTHWESTERN SWAZILAND

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I. INTRODUCTION.

GEOGRAPHY.

Swaziland is a British Protectorate of approximately 6,700 square miles. It is a subtropical country, bordered in the East by Mozambique and in the North, West and South by the Transvaal. There are approximately 270,000 Africans and 10,000 persons of other races living in the Territory. The country is divided into Highveld, Middleveld and Lowveld regions. The work described here was carried out in the South Western highveld. This is mountainous terrain, with an approximate altitude of 3,500 feet and an annual rainfall of about 30". The terrain is a succession of mountains and valleys, with several perennial streams and rivers coursing through it. The climate is variable, with hot summers and cold winters, with rainfall predominantly in the summer. Large man made forests are scattered throughout the area, and there is some cutting and processing of timber, but industries as such are not found in that part of the Territory.

There is little land for agricultural use. The majority of people keep cattle, goats and pigs, and grow a small quantity of maize for their own use. Apart from maize, there are no crops of any importance in that part of the country; European farmers grow tobacco, but the Swazis have not taken to this. Fruit and vegetables are scarce, and dairy products of African origin are almost non existent. Sheep from outside the Territory are often sent to the Highveld for winter grazing.

POPULATION.

The African population is homogeneous, consisting almost entirely of Swazi people. Tribal cohesion is marked and highly developed in the older generation, but detribalisation is well advanced among the younger people. Young men and women seek employment in other parts of the Territory and in the towns in the Republic of South Africa. It is extremely difficult to subsist, let alone live, on local earnings only.

Fertility is high, as is mortality; 50% of the population is under 20 years of age. Social problems in the forefront are illicit liquor brewing, prostitution, illegitimacy, and child neglect and abandonment. Gambling has also become widespread in the area, and the growing and consumption of dagga is spreading.

The economy runs at the bare subsistence level. Most of the resident people are peasant farmers, who lead a hand to mouth existence. Cash has to be earned elsewhere, either within or outside the Territory The population settled in the South-Western highveld is about 15% of the total population, approximately 40 thousand souls in all; population density is 66 persons per square mile. The land suitable for agriculture is overstrained by the human and cattle population.

Housing is of the rondavel type, consisting mostly of wattle and daub structures. There are, however, some European type houses also, and their number is growing.

Water supplies are drawn from the rivers where these are available, or from wells. The rivers are public sewers, as in most parts of primitive Africa. Typhoid fever, amoebic dysentery and bilharzia are common, though schistosomiasis is rare in the South-Western areas compared to the rest of the country.

MEDICAL SERVICES.

The South Western part of the Highveld, comprising chiefly the Hlatikulu and Mankaiana administrative districts, is served by both government and mission hospitals.

Mission Hospital. Mahamba Methodist Hospital, situated at Mahamba, about half a mile from the Transvaal border, was established in 1951. It existed as a 100 bed hospital for general, maternity and tuberculosis patients until December, 1963, when it was closed down for financial reasons. It is to be taken over by the Swaziland Government as a tuberculosis hospital.

Clinics. Four clinics were served from Mahamba. Two were established by the Methodist Church and were situated 25 and 110 miles away respectively; two were established by another Mission and were located 28 and 42 miles away respectively. The Methodist Clinic which was 110 miles away was situated in the Lowveld, and does not figure in this survey.

Government Hospitals. Hlatikulu Hospital, 135 beds, and Mankaiana Hospital, 28 beds. Hlatikulu is 30 miles from Mahamba, and Mankaiana is 45 miles from Mahamba.

Clinics: One at Goedgegun, 11 miles from Mahamba, with a resident doctor. Eight others scattered throughout the area, visited by government doctors.

Personnel: The Government hospitals and clinics had the services of five doctors; the Methodist medical mission had one doctor only.

Public Health: Country wide public health services are provided by the Medical Officer of Health and his staff. Public health work has resulted in the almost total eradication of malaria in the Territory. Work is in progress on bilharzia and on tuberculosis control, as well as on the provision of sanitary water supplies and other problems. Maternity and child welfare work is carried out by hospitals and clinics, not by the Health Department. A significant omission from the public health field is a school medical service.

SCHOOLS.

Schooling is not compulsory for Swazi children. The percentage of children who attend school is low, in the region of 30 per cent. Thus there are two children of school-going age at home for every one who attends school. Of the children who do attend school, the majority have only three to five years of schooling; after standard four there is a mere trickle to the higher classes.

Regulations for school attendances have recently become more strict. Since 1961 children are no longer admitted to the Grades (sub-standards) after the age of 10, and they are no longer admitted to the Forms (standard seven and higher) after the age of 16. This does not, however, apply to pupils who were already at school before these regulations came into force.

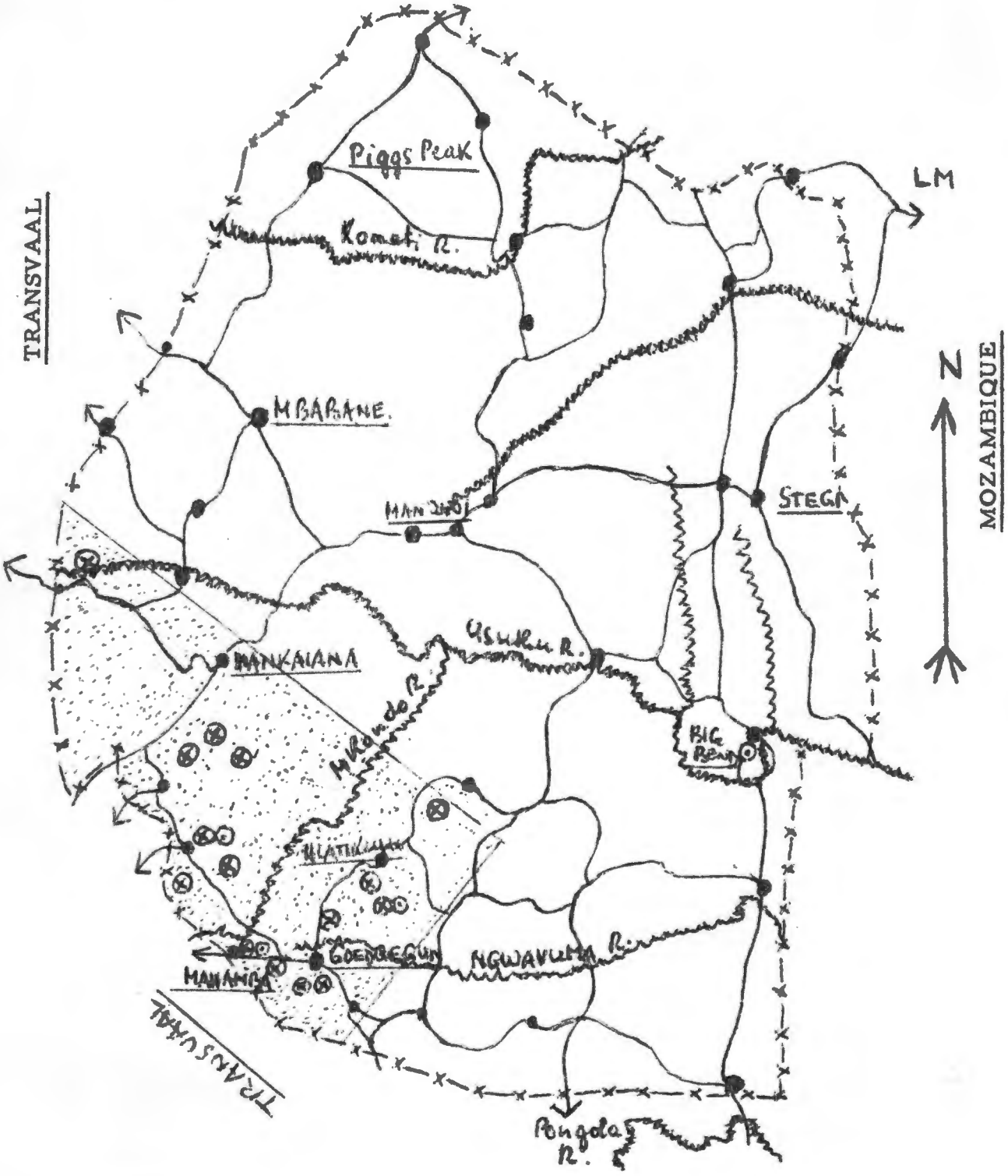
There are 25 schools in the area surveyed, of which five are government schools and twenty mission schools. Of these latter 13 are Methodist schools, with a total of approximately 2,500 pupils. The School Health Service to be described was started for Methodist schools only, but in the second year two other unrelated schools also joined, bringing the total of pupils to about 3,000. Of the schools taking part in the health service, two were high schools, nine were primary schools up to standard six, two went to standard four only, and two went to standard two only. The Schools are scattered widely throughout the area; names and distances from Mahamba are as follows:

Mahamba Methodist School (on same mission station).
Nsongweni School (16 miles).
Gege Methodist School (25 miles).
Mashobeni School (20 miles).
Thawela School (45 miles).
Mahlangatsha School (42 miles).
Seyendle School (36 miles).
Dudusini School (29 miles).
Usuthu School (90 miles).
Thembelihle School (45 miles).
Madulini School (30 miles).
Nkoneni School (18 miles).
Nyamane School (18 miles).
Mbukwane SDA School (7 miles).
Edwaleni School (28 miles).

The mission schools and clinics mentioned are shown on the accompanying map.

SKETCH MAP OF SWAZILAND

SHOWING SCHOOL HEALTH AREA



Legend

- ⊗ S = School
- ⊙ C = Clinic
- ● Town/Village
- —x—x— Border
- ——— Roads
- ~~~ Rivers
- School Health Area

Scale:

20 miles = $1\frac{1}{4}$" approx.

II. THE SCHOOL HEALTH SERVICE

There is no specific health service for schoolchildren in Swaziland. Schoolchildren in need of medical atention go to the hospitals or clinics or the witchdoctors for treatment; when not ill they are never seen by doctors. By talking to a large number of parents and teachers and children, I learnt that the connection between health and scholastic performance was not appreciated. Parents argued that their children would not be going to school if they were not "healthy". Teachers were aware of occasional acute illness in scholars, but assured me that there was little or no chronic ill health or latent disease. Neither teachers nor parents appreciated the need for periodic health examinations, as early or incipient ill health did not exist in their thinking, and prevention of illness was a new concept to them. Even the possibility of better examination results in healthier pupils was not considered. The pupils themselves were neither health nor hygience conscious. In the higher classes they received some instruction in hygiene (socalled Health Education), but they thought this subject completely divorced from their everyday activities.

a) PURPOSE

When I decided to organise a schoolhealth service for our pupils, the aims were :-

1) To get reliable measurements of height and weight for the different age groups: without this information, which at that time was not available elsewhere, one cannot judge abnormal heights and weights and one cannot therefore, tell undernourished from normally nourished pupils.

2) To make a survey of the health of Swazi schoolchildren and to get an idea of the incidence of the different diseases among them.

3) To define the most important and pressing health problems in this group.

4) To remedy such diseases as were within our power to treat.

5) To prevent certain diseases by immunisation and vaccination.

6) To improve the scholastic performance as the result of better health.

7) To make Swazi schoolchildren health conscious. The children of today are the parents of tomorrow; if they could be made health conscious we might look forward to a health conscious nation in the future.

As regular organised medical examination of schoolchildren had been non-existent in Swaziland, we had to break completely new ground. The hostility and opposition we encountered were not unexpected; it came from

parents and teachers and the children themselves. Before we could make concrete plans for the service, we first of all had to persuade parents and teachers and pupils that such a service was desirable.

If this hurdle could be cleared, then the question of staff arose. At Mahamba I was the only doctor in a hundred bedded hospital and had, besides this, four district clinics to serve. I was already absent from Mahamba two days a week. Would there be time to visit schools in addition? Or should one concentrate on one or two schools only as a preliminary measure? How big a staff would be required to run such a service? As the hospital was at that time bankrupt, who would finance such a service? If we did start a school health service, how comprehensive should and could it be? Would there be enough time to give advice to individual pupils and to prescribe treatment?

b) DURATION OF EFFORT

The plan to start a school health service was conceived early in 1961. The Mission Superintendent was also the grantee of our schools, and he and his staff were informed of our intention. The grantee had frequent contact with parents and teachers at all our schools; his help was therefore vital, and he made much preliminary propaganda. In addition, I myself interviewed as many teachers as possible, and introduced them to the idea of a school health service. At a teachers' holiday camp in July 1961 I was able to address all the head teachers; they promised to co-operate and to attempt to "sell" the idea of a school health service to parents and scholars. Preliminary propaganda and organisation took all of six months, and the school health service started in August 1961. It continued until December 1963, when medical work in Swaziland was given up by the Church.

The projected School Health Service would be run according to the following plan :

> Every child in every Methodist school in South Western Swaziland would have an annual complete physical examination, including an eye test if in the standards. Heights and weights would be taken, and all body systems would be briefly examined. Information obtained would be recorded on a printed card, numbered for each pupil. The card would give the full name and age of the pupil, and his class in school. Blue cards were used for boys, pink for girls. The cards would be completed by the doctor and filed at the hospital for future reference. On the completed card each pupil would be assessed as healthy and fit, or unhealthy and/or unfit. Diseases would be recorded at the bottom of the card, as would any treatment given.
>
> Each pupil would pay 10c for the examination, and a further 10c for treatment if this were required, and if the pupil came for it.

c) ORGANISATION.

At the Mahamba school the pupils were seen in the out-patient department of the hospital. Other schools were visited by ambulance, and equipment necessary for the examinations was carried on each trip.

i. Staff and travelling. At Mahamba I had the help of the hospital staff and the clerks; at other schools teachers only were available in 1961 and 62. In 1963 my wife, a qualified nursing sister, accompanied me and assisted in various ways. Travelling on the bad Swaziland roads was a strain on both vehicle and occupants, and equipment had to be sturdy to prevent breakages.

ii. Procedure and development. Schools were notified well in advance of the date of our visit. On arrival at a school cards were given out and the teachers filled in the name, age and class of the pupil. Female teachers did the girls, male teachers the boys. Twenty or thirty cards were then collected, and the children were examined. Boys and girls were kept strictly separate, and were never examined together. Boys were examined in the presence of a male teacher, girls in the presence of a female teacher. Classrooms were used for the examinations, as no other suitable accommodation was available at any of the outside schools. Parents of the schoolchildren were encouraged to be present at these examinations, but men were barred from attending when girls were being examined, and women were not allowed when the bigger boys were examined.

The group to be examined was first measured and weighed; height and weight were recorded on the pupil's card. After this the general examination was done, and eye testing ended the session.

In our first year, 1961, due to lack of time, only the above were done. In 1962 the above examinations were repeated, but in addition each child clinically anaemic had a haemoglobin estimation done. In 1963 all the above were repeated, and in addition every child had a Mantoux test, two typhoid/paratyphoid injections, and a smallpox vaccination. This necessitated two visits to each school in 1963, whereas in the previous years only one visit was made.

Heights and weights, and deviations from normal, were filled in on the cards at the time of the examination. Cards were completed on return to Mahamba. Significant abnormalities were brought to the notice of teachers, pupils and parents as follows:- In 1961 a typed list of unhealthy pupils was sent to the head teacher of each school visited. It was soon found that teachers did not bother to inform the pupils and their parents of our findings. Therefore in 1962 a printed slip, bearing the name and number of the pupil, the disease found, the name of the school and the date, was sent to the head teachers of the different schools. Although the majority of the pupils lost their slips, most of the pupils did at least receive them and took them home. The same procedure was

accordingly adopted in 1963.

A complete list of pupils, giving their names, numbers, and diseases, was kept by me at the hospital, in addition to the cards which were also in my possession. Pupils still at school in the year following the first examination were again issued with their old cards. Thus records of pupils were in many cases available for three years running.

It will thus be seen that from a modest start the School Health Service developed from one year to the next into a fairly comprehensive endeavour. Had our medical work not been terminated the School Health Service would have become part and parcel of Methodist schooling in Swaziland. It is obvious that a single handed observer cannot cover all the ground there is to be explored, but it is contended that at least a start was made. The information collected should be of some use to other observers in the future.

III. DATA.

(A) HEIGHTS AND WEIGHTS.

1) HEIGHTS. The total number of measurements in boys aged 6-18 years is 3214; this includes a number who were measured two years in succession.

The total number of measurements in girls aged 6-16 years is 2557; this again includes a number who were measured two years in succession.

Method: Height was recorded in inches, to the nearest half inch. Where a pupil measured more than half an inch it was recorded as the next higher inch; where a pupil measured less than half an inch it was recorded as the next lower inch. In this way, fractions of half inches nearly cancelled one other out, and the average was influenced hardly at all.

Pupils were measured standing upright against a wall, their hands by their sides, chin level (Attention posture). All pupils were measured without footwear, as it was found that the majority of pupils did not have shoes. The scale was marked off against the wall as follows: A weighted sixty inch tape measure was held against the wall and allowed to swing free, so that it was perfectly vertical. Feet and inches were then marked off on the wall at right angles to the tape measure. It was found necessary for accuracy to do this, as very few walls in the schools were found to be perpendicular or straight. A ruler placed on the pupil's head gave the level. The same method was used at all schools on all occasions. Observations were made by me personally and entered immediately on the pupil's card. Children with skeletal deformities were not measured. Pupils whose age was uncertain were excluded from the calculations.

Measurements from all the schools have been pooled for making the final calculations.

2) WEIGHTS. The total number of observations in boys aged 6-18 years is 3214; this includes a number who were weighed two years in succession.

The total number of observations in girls aged 6-16 years is 2557; this also includes a number who were weighed two years in succession.

Weights were recorded in English pounds, to the nearest pound, i.e. over half a pound was read as the next higher pound, under half a pound was read as the next lower pound. The ordinary balance (lever scale) used in hospitals could not be used for these children, as it is bulky and likely to get out of order when transported over bad Swaziland roads. Therefore a new spring scale (bathroom scale) was bought and reserved exclusively for schoolchildren. The scale was adjustable, and after every visit to a school it was compared with and standardised against the hospital balance (lever scale). Weights were taken by myself and recorded immediately

on the pupil's card.

Boys were weighed wearing a khaki shirt and khaki shorts, without footwear; girls were weighed in a gym dress and knickers, also without footwear.

Children whose age was uncertain were not included in the calculations.

Weights from all the schools have been pooled for making the final calculations.

3) INACCURACIES. The ages of the pupils were obtained by the teachers from the school registers; though the majority of ages recorded were correct, in many cases they were obviously wrong. Where the child's apparent age did not correspond with that given in the school register, further enquiries were made. When, after consultation with the pupil and the parents, teachers had ascertained the real age, this was entered on the card. For example, children over 16 who wanted to stay at school often dropped two or three years for register purposes, but when they realised that the school health examinations would in no way influence their remaining at school they readily confided their real age. In several cases also the pupil just did not know how old he or she was, as birth registration is not compulsory in Swaziland. In such cases an estimate was made of the age, but heights and weights obtained were not included in the final calculations. In my own mind I am sure that the ages of pupils as recorded on their school health cards are nearly 100 per cent accurate.

In every case the age written on the card is the age of the pupil on his or her last birthday.

4) COMPILATION OF FIGURES. The school health examinations were started in August 1961; all heights and weights recorded then are first measurements. All the schools were revisited in 1962, starting in February. Therefore most of children still at school from 1961 were measured and weighed again less than twelve months later. These weights and heights have been recorded on the cards, but have not been used in the final calculations. New arrivals were of course also measured and weighed; their weights have been used in the final calculations. In 1963 all schools were again visited and the observations repeated; this time it was possible to visit the same school in the same month the following year. Heights and weights taken in 1962 were thus repeated a year later, and these have been used in the calculations.

Heights and weights are therefore

i. First heights and weights of all pupils examined over three years.

ii. Heights and weights taken twelve months later in the case of some pupils.

All these have been pooled into one total for boys and one total for girls according to the age group.

5) TABLES OF AGE SPECIFIC HEIGHTS AND WEIGHTS FOR SWAZI BOYS AND GIRLS.

BOYS. (3214).

Age in years.	Observations		Range		Totals		Average	
	Ht	Wt	Ht	Wt	Ht	Wt	Ht	Wt
6	60	60	3'2"-4'6"	33-67 lbs	225'2"	2601 lb	3'9.0"	43.35 lb
7	186	186	3'2"-4'8"	32-68 lbs	714'4"	8776 lb	3'10.0"	47.18 lb
8	232	232	3'0"-4'11	39-76 lbs	935'4"	12282 lb	4'0.3"	52.94 lb
9	260	260	3'5"-4'9"	40-85 lbs	1094'6"	14980 lb	4'2.5"	57.61 lb
10	282	282	3'9"-5'4"	49-116 lbs	1244'7"	18136 lb	4'4.9"	64.31 lb
11	265	265	4'0"-5'6"	50-120 lbs	1204'5"	18503 lb	4'6.5"	69.10 lb
12	334	334	4'0"-5'8"	51-130 lbs	1568'11"	25881 lb	4'8.3"	77.48 lb
13	251	251	3'10"-5'9"	45-145 lbs	1244'4"	22023 lb	4'11.4"	87.74 lb
14	219	219	4'0"-6'0"	65-150 lbs	1142'1"	22744 lb	5'2.5"	103.85 lb
15	184	184	4'8"-6'0"	79-165 lbs	990'7"	21489 lb	5'4.6"	116.73 lb
16	145	145	5'0"-6'0"	85-160 lbs	794'5"	18681 lb	5'5.7"	128.83 lb
17	109	109	4'10"-6'0"	98-166 lbs	602'11"	14589 lb	5'6.4"	133.84 lb
18	87	87	5'3"-6'2"	110-180 lbs	486'3"	12203 lb	5'7.0"	140.26 lb

GIRLS. (2257)

Age in years	Observations		Range		Totals		Average	
	Ht	Wt	Ht	Wt	Ht	Wt	Ht	Wt
6	93	93	3'4"-4'4"	31-55 lbs	344'3"	3976 lb	3'8.4"	42.75 lb
7	251	251	3'2"-4'8"	30-72 lbs	958'4"	11629 lb	3'9.8"	46.33 lb
8	343	343	3'6"-4'8"	35-80 lbs	1371'0"	17499 lb	3'11.9"	51.02 lb
9	335	335	3'6"-4'11"	39-92 lbs	1398'9"	19209 lb	4'2.1"	57.34 lb
10	286	286	3'8"-5'2"	36-100 lbs	1255'9"	18601 lb	4'4.6"	65.04 lb
11	238	238	4'0"-5'4"	50-110 lbs	1092'9"	17353 lb	4'7.1"	72.91 lb
12	338	338	4'0"-5'6"	44-131 lbs	1608'11"	27742 lb	4'9.1"	82.08 lb
13	238	238	4'3"-5'6"	64-136 lbs	1180'0"	22631 lb	4'11.5"	95.08 lb
14	207	207	4'3"-5'6"	60-154 lbs	1048'3"	22188 lb	5'0.7"	107.18 lb
15	143	143	4'6"-5'7"	90-153 lbs	732'0"	16483 lb	5'1.4"	115.26 lb
16	85	85	4'9"-5'7"	91-165 lbs	439'6"	10580 lb	5'2.0"	124.47 lb

In the above tables in the Range and Total columns heights and weights are given to the nearest inch and pound respectively.

ANNUAL GAINS IN HEIGHT AND WEIGHT OF SWAZI SCHOOLCHILDREN.

BOYS.			GIRLS.		
Gain at end of	Height	Weight	Gain at end of	Height	Weight
6th year	1.0"	3.83 lb	6th year	1.4"	3.58 lb
7th "	2.3"	5.76 lb	7th year	2.1"	4.69 lb
8th "	2.2"	4.67 lb	8th year	2.2"	6.32 lb
9th "	2.4"	6.70 lb	9th year	2.5"	7.70 lb
10th "	1.6"	4.79 lb	10th year	2.5"	7.87 lb
11th	1.8"	8.38 lb	11th year	2.0"	9.17 lb
12th	3.1"	10.26 lb	12th year	2.4"	13.0 lb
13th	3.1"	16.11 lb	13th year	1.2"	12.1 lb
14th	2.1"	12.88 lb	14th year	0.7"	8.08 lb
15th	1.1"	12.10 lb	15th year	0.6"	9.21 lb
16th	0.7"	5.01 lb	x	x	x
17th	0.6"	6.42 lb	x	x	x

6) COMMENTS ON HEIGHTS AND WEIGHTS.

Until the age of 11 the girls are less tall than the boys; thereafter, at ages 12 and 13, the girls are taller. After the age of 13 the boys overtake the girls once more.

In the age groups 6-9 years the boys are heavier than the girls; after the age of 10 the girls are heavier until 14 years of age, whereafter the boys overtake them once more. Eventually, boys have the advantage in both height and weight. The increase in the weight of the girls in the age groups 10-14 may be due to the spurt of growth at or before puberty. It is, however, not clear why the boys are heavier than the girls in the 6-9 age groups, as the girls work with the food at home and have the pot scrapings as their own supplementary food.

In the case of the girls, about puberty (11-14 years) there is an increase in height which is only a year or two later followed by a marked increase in weight. In boys, puberty (age 13-15) is marked by a

simultaneous increase in height and weight.

With regard to annual gains in height and weight: in boys there are two spurts of height increase, about the 7th to 9th year, and again from 12 to 14 years. In girls there is an almost regular gain in height from 7-12 years, after which height gain decreases, but there is a spurt of weight gain during the 13th and 14th years.

In the overall picture, periods of weight gain are very similar in the two sexes; in boys the period of greatest gain in weight is from 10 to 15 years, while in girls it is from 11 to 15 years. This increase in weight in the sexes is probably related to the changes of puberty. Kark has shown that Bantu girls who had reached puberty were taller and heavier than girls of the same age who were not yet pubescent; she also demonstrated an increase in weight gain in girls after the age of 11 years. [1]

Data on heights and weights have been presented as graphs also; these give a better overall picture of our findings.

7) COMPARISON WITH OTHER SERIES.

Several other sets of figures giving the heights and weights of school-children are available for comparison with my figures. All except one series deal with non-Swazi children.

The heights and weights of our Swazi pupils are on the 25th percentile of the well known Boston scale; they are therefore considerably shorter and lighter than their American counterparts. Height and weights for British boys and girls up to the age of 14 are given by R. S. Illingworth.[2] Compared with Illingworth's figures, our children are both shorter and lighter than British children up to the age of 13 years; after this they equal and even pass British children. Lurie and Ford[3] record the heights and weights of European and Coloured schoolchildren in Cape Town, and compare these with equivalent British and American figures. Comparing their figures with mine, we find that our Swazi children are not as tall and as heavy as Cape Town European children, but they are both taller and heavier than Cape Town Coloured children. This holds for both boys and girls. With regard to the rate of growth, i. e. annual gains in height and weight, Lurie and Ford find nothing in their figures to support the commonly held belief that growth occurs in spurts. R. Logan, however, states with regard to girls "the growth spurt reaches its maximum around the age of twelve and begins to decline with the menarche at about thirteen, and is almost over by seventeen." [4] In my series there is definite evidence of a spurt in growth at about the time of puberty, though this does not mean that there is no growth at other times. Periods of accelerated growth, in both boys and girls, are clearly shown in my figures and graphs. A. R. P. Walker [5] records the heights and weights of 15 year old European, Indian and Bantu boys, and of 15 year old Bantu girls. Comparing his figures with mine, we find that our Swazi boys weigh as much as their European counterparts and the best

nourished Indian boys, but they are slightly shorter than both these groups. Our boys are, however, both taller and heavier than the less favoured Bantu and Indian groups studied by Walker. Our Swazi girls at the age of 15 are taller and heavier than any of the groups of Bantu girls studied by Walker. In his paper figures are given for 15 year old children only; the primary purpose of his study was not the recording of heights and weights.

The most pertinent series of observations with regard to heights and weights of Swazi children is that of Jones [6]. As part of her Swaziland Nutrition Survey she measured and weighed 243 boys and 249 girls, aged 6-16 years. She started her work in 1961 and worked independently of us. At the end of the first year of our school health service I calculated the age and sex specific heights and weights of our schoolchildren, and gave the figures to Jones for comparison with her own figures. In her report she presented tables and graphs of my figures together with her own; as we worked with much larger numbers our curves are more smooth than hers. For the purposes of her publication she converted our figures to the metric scale. It is noteworthy that both my preliminary (first year) and my final (pooled three year) figures compare and agree quite well with those of Jones. Our heights agree much more closely than our weights, but even the weights agree well. Jones in her work encountered the same difficulties which plagued us with regard to the ages of some of the pupils. The fact that our figures for heights and weights are so similar suggest that both of us are in fact very close to the truth. Jones' published figures refer chiefly to schoolchildren, and our series are therefore comparable.

Jones found no regional variations in heights and weights, and she therefore pooled her figures, just as we did. It is interesting to note that she, too, found spurts of growth in these children, particularly with regard to weight gain, between the ages of 12 and 15 years. Both my figures and those of Jones can be regarded as having been checked; Jones measured and weighed her children again six months after her initial observations; I re-weighed and re-measured my pupils six or twelve months after my first observations.

Finally, it must be pointed out that my figures were obtained for the purpose of compiling height and weight tables for Swazi schoolchildren in the different age groups, and for both sexes. This information has not hitherto been available elsewhere. Comparison of my figures with those of other observers may tell us little or much; Jones' figures serve as a useful check on mine, and vice versa. Since both of us dealt with comparable series of children her figures and mine establish the validity of our observations. Comparison of our figures with those of other observers working with different ethnic groups is an interesting exercise, but tells us little of real value. It is doubtful whether comparisons between different ethnic groups in the same or in a different continent are valid. Such differences are often taken as reflecting differences in economic status between such groups, but it is obvious that height

and weight are determined by many other factors as well. On the face of it, a child of a certain age who is taller and heavier than another child of the same age would appear to be better nourished and more privileged economically than the smaller child. But factors such as race, climate, geography, food fads and individual eating habits, as well as social factors, are also active in determining height and weight, and such factors must be taken into account also. Even if at a certain age one child is taller and heavier than another in a different group, this is a quantitative difference; whether or not the smaller child is less healthy, both immediately and in the long run, than his bigger contemporary, remains to be proved. It is all too easy to assume, but extremely difficult to prove, that "bigger" is synonymous with "better".

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(B) ONSET OF MENSES IN SWAZI GIRLS.

Girls were questioned by lady teachers regarding the onset of their menses. Very few pupils knew their birthday, and the minority knew the date of onset of their menses or even the month. However, with patience the majority remembered the year and the season. Only girls who had menstruated regularly up to the time of the interview were accepted for the records. The girl's age at the last birthday preceding the onset of her menses was then recorded; greater accuracy then this was not possible. 383 girls were sure of the year and the season. Of these

14 started their menses at the age of 11, i. e. 3. 65%
35 started their menses at the age of 12, i. e. 9. 14%
116 started their menses at the age of 13, i. e. 30. 28%
134 started their menses at the age of 14, i. e. 34. 98%
65 started their menses at the age of 15, i. e. 16. 97%
19 started their menses at the age of 16, i. e. 4. 96%

The total ages of onset added together give 5237 years; if this total is divided by the number of menstruating individuals, we get as the average age of onset 13. 67 years or 13 years 8 months. These results are not substantially different from those of other series and are very similar to those quoted in textbooks for British and American women. [1, 2, 3.] In European and American women there has been a tendency over the last decades for the menarche to occur earlier in life. Menses have occurred a third of a year earlier for every decade over the last century. [4, 5.] Such a tendency could only be discovered in African women by investigations extending over several decades. However, my figures contradict the commonly held belief that girls in warm climates are "ripe" before their sisters in colder climates.

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(C) MANTOUX TESTS.

In 1961, the first year of the school health service, there was no time to carry out tuberculin testing. We had decided to start this in 1962, but we then heard that WHO were about to start tuberculin testing in the Territory; we therefore decided to leave this investigation to them. However, at the end of 1962 they had not yet started with this, and thus we decided to do our own tuberculin testing. Tuberculin tests were therefore done on all pupils in our schools in 1963.

A Heaf multiple puncture apparatus was used for these tests: it was set for 2 mm penetration for all pupils. The tuberculin used was Purified Protein Derivative, (PPD), strength 2 mg per cc. The flexor aspect of the left forearm was cleaned with ether, and then one drop of PPD was applied with a platinum loop. In cases where there was a rash in this area, another site was used. Results in all children were read after one week. By that time pseudoreactions had been eliminated and only frank positives would show. Four or more visible or palpable puncture marks were regarded as positive.

Over three thousand tests were done, of which 2,903 were read; there were 1,413 boys and 1,490 girls. Pupils were aged six to eighteen years.

RESULTS:

Of the 1,413 boys, 704 or 49.82 per cent were positive,
of the 1,490 girls, 690 or 46.30 per cent were positive,
and of the 2,903 pupils, 1,394 or 48.06 per cent were positive.

Detailed age/sex specific results are as follows:

(percentages are given to one decimal place only).

BOYS.

Age	Tests	Positive	Percent
6	28	12	42.8
7	75	26	34.6
8	110	36	32.7
9	137	53	38.6
10	145	45	31.0
11	150	78	52.0
12	135	74	54.8
13	142	69	48.5
14	163	88	53.9
15	117	76	64.9
16	82	55	67.0
17	79	53	67.0
18	50	39	78.0

GIRLS.

Age	Tests	Positive	Percent
6	35	8	22.8
7	121	36	29.7
8	172	64	37.2
9	206	65	31.5
10	146	65	44.5
11	142	68	47.8
12	181	91	50.2
13	161	95	59.0
14	145	78	53.7
15	100	63	63.0
16	56	39	69.6
17	20	14	70.0
18	5	4	80.0

A combined table for males and females shows the following percentages.

Age	Male	Female	Both
6	42.8	22.8	32.8
7	34.6	29.7	32.2
8	32.7	37.2	34.9
9	38.6	31.5	35.1
10	31.0	44.5	37.7
11	52.0	47.8	49.9
12	54.8	50.2	52.5
13	48.5	59.0	53.7
14	53.9	53.7	53.8
15	64.9	63.0	63.9
16	67.0	69.6	68.3
17	67.0	70.0	68.5
18	78.0	80.0	79.0

The above results are also shown as a graph.

During 1956 and 57 a WHO team carried out tuberculin testing in Swaziland as part of a tuberculosis survey of the three High Commission Territories. [1] They also used PPD, injecting 5 tuberculin units in 1/10 ml diluent intracutaneously into the dorsal area of the left forearm. Their results were read after three or four days by measuring in millimetres the transverse diameter of the induration. They did not classify the results as positive or negative, but classified those with reactions of 10 mm or more as infected. The WHO team tested all age groups and both sexes; their tables show the combined results for both sexes.

From a graph given in the WHO report, on page 12, it appears that roughly

5% are tuberculin positive at the age of 2 years
20% are tuberculin positive at the age of 7 years
35% are tuberculin positive at the age of 10 years
60% are tuberculin positive at the age of 15 years
and 75% are tuberculin positive at the age of 20 years

These figures are in substantial agreement with my own. A more detailed comparison between the WHO results and mine shows the following:

Age Group (years)	Percent positive (Laufer)			Percent infected (WHO)		
	Male	Female	Both	Male	Female	Both
0 - 4	xx	xx	xx	4.2	6.5	5.5
5 - 9	xx	xx	xx	23.9	23.9	23.9
6 - 9	37.2	30.3	33.7	xx	xx	xx
10 -14	48.0	51.0	49.5	45.5	45.1	45.3
15 -19	xx	xx	xx	70.7	69.0	69.7
15 -18	69.2	70.6	69.9	xx	xx	xx

COMMENTS ON THE RESULTS OF THE PRESENT SERIES.

The figures given are the pooled results from all the schools, to give the overall picture for the area. The percentage of positive reactors varied from one school to the next; while one school showed 23% positives, another at the other end of the scale showed 67% positives. Most schools fell between these two extremes. Some schools are situated in heavily tuberculotic areas, others in less heavily infected districts. Check up on tuberculosis patients in the different districts showed the close relationship between cases and tuberculin positive schoolchildren. In both boys and girls, roughly half the children are tuberculin positive by the age of twelve, while roughly two thirds are positive by the age of sixteen (theoretical school leaving age). This leaves half the children susceptible and unprotected at the age of twelve, and one third susceptible and unprotected at the age of sixteen. The unexpectedly high percentage of positive reactors among boys aged six and nine years, and among girls aged eight years, is mostly probably due to regional influences only.

In this connection the findings of other observers are of interest. Cluver[2] states "In South Africa the majority of non-Europeans acquire immunity at a very early age. Surveys show that figures up to 80% or more positives at two years of age are not uncommon." He does not quote his sources for this statement, which appears to be an overall assessment.

For Africa and Asia as a whole, WHO figures[3] show a higher percentage of positives in cities than in country districts. WHO figures vary, for city dwellers, between 50 and 80 percent positives at the age of fifteen.

In the USA there are wide regional variations, the population as a whole being about 30 percent tuberculin positive; percentages are higher in the Eastern parts of the country. On the Continent of Europe, infection in cities like Paris, Vienna and Zurich was almost universal before the first World War. At present the majority of city dwellers throughout the world have a positive tuberculin reaction before the age of forty.

In England and Wales there has been a fall in tuberculin positives since World War II, and this is still continuing. The Prophit Survey in 1946 gave 90 percent positives at the age of 20; The M.R.C. Survey in 1948-50 gave 75 per cent positives at the same age.[4] In London, fifteen year olds were 30% positive in 1949, but only 15% positives in 1958. In England and Wales as a whole, children gave the following results:

Boys, 15-16 years: 1934-44 -63% pos. 1948 -40-55% pos.

All children 19-20: 1934-44 -80-85% pos. 1948 -59-74% pos.

In Manchester in 1956, factory workers under 26 years were 50% positive, as were pregnant women. University students were only 10% positive.[5] In Northern Ireland, Belfast children aged 5-7 years gave 25% positive reactions in 1950, while children aged 4-7 gave 3.9% positive reactions in 1957.[6] Exposure to tuberculosis would therefore appear to be as heavy in Swaziland with its predominantly rural population as it is in the United Kingdom with its predominantly urban population, and even heavier when the latest British figures are considered.

In the present series clinical tuberculosis (all forms) was diagnosed in 29 children; two had tuberculous lymphadenitis, one had abdominal tuberculosis, one had lupus vulgaris, and twenty-five had pulmonary tuberculosis. This in no way reflects the true incidence of the disease, as sick children would either stay at home on the day of our visit, or would not be sent for schooling at all. In addition, early cases are likely to go unrecognised if only clinical methods of diagnosis are used. A WHO team in 1956/57 examined 1,548 persons of both sexes aged thirteen years and

older, and found that 16 of these excreted tubercle bacilli in their sputa, though they were not clinically recognisable tuberculotics. This gives an incidence of 1.03 percent bacilli excreters in this sample of the Swazi population.[7] In 1962 a different WHO team repeated these tests, and found that of 3,254 persons showing X ray evidence of chest disease, 37 or 1.1% were excreting tubercle bacilli in their sputa.[8] During 1963, hospitals in Swaziland admitted 1,176 cases of tuberculosis, while total hospital admissions for the year were 16,693; tuberculosis thus made up 7% of all admissions.[9] Tuberculosis is the biggest single health problem in Swaziland at present; the urgent need for BCG vaccination on a large scale, together with other appropriate measures, is obvious from the above figures.

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(D) GENERAL SICKNESS STATISTICS.

When the children had been measured and weighed, boys removed their shirts and were examined wearing khaki trousers only; the majority wore shorts, though some of the bigger boys wore long trousers. Girls undressed and were examined wearing knickers only. In both sexes the umbilicus had to be visible; genitals and perineum were not examined as the necessary privacy was lacking.

Having undressed as above, pupils stood in a line of twenty or thirty, and the physical examination commenced. A general inspection was first made, viewing the pupil from the front, to assess nutrition and development. Posture and habitus, made much of by some observers, were disregarded in these pupils, as the slouch with hanging head and drooping shoulders (so called fatigue posture) was universal in these children. They had to be stood up well away from the wall, otherwise they would lean against the wall even while being examined. If told by the teacher to stand at attention they could readily do so and could sustain this posture throughout the examination. This suggested that the bad posture was a habit, not disease conditioned.

After the general inspection, which included the skin, the mouth was examined, followed by the throat, tongue and eyes. Anaemia was diagnosed by pallor of the conjunctiva and tongue. Mouth and throat examination were followed by palpation of the neck and axillae for glands. The above examination was done in all pupils all along the line. Thereafter chest examination, followed by abdominal inspection and palpation, was done in all pupils, again all along the line. When this had been completed, all the pupils turned about and a general inspection was made from behind, followed by chest examination and palpation of the spine in all pupils.

It was found that this system of examination gave a greater chance of spotting abnormalities, as pupil could be compared with pupil, throat with throat, chest with chest, back with back, and so on. Where significant abdominal findings were present the child was kept back and examined lying down. Significant skeletal abnormalities also were re-assessed at the end of the examination. Physical examination was followed by an eye test; then clinically anaemic pupils had a haemoglobin estimation done. This was followed by Heaf tests and inoculations.

This standardised technique allowed one to deal with up to 250 pupils per day, between the hours of 9 a.m. and 5 p.m.

a) Incidence of the different diseases.

This is given for each of the three years of the school health service; a composite table of averages based on the individual years is also given.

1961.

Total boys examined	994.	Unhealthy 432.	Percentage unhealthy 41.
Total girls examined	1018.	Unhealthy 437.	Percentage unhealthy 43.5.
Total pupils examined	2012.	Unhealthy 905.	Percentage unhealthy 42.2.

ANALYSIS OF DISEASE GROUPS.

Disease	Unhealthy pupils (total 905, Refr. 500)						All pupils (total 2012, Refr. 1162).					
	Boys (432)		Girls (473)		All (905)		Boys (994)		Girls (1018)		All (2012)	
	No	%	No	%	No	%	No	%	No	%	No	%
Anaemia	156	36.1	237	50.1	393	43.4	156	15.7	237	23.2	393	19.4
Ear/Nose/Throat	96	22.2	112	23.7	208	23.0	96	9.6	112	11.0	208	10.3
Mal-nutrition	54	12.5	23	4.8	77	8.5	54	5.4	23	2.2	77	3.8
Respira-tory	63	14.5	47	9.9	110	12.1	63	6.3	47	4.6	110	5.4
Skins	30	6.9	14	2.9	44	4.8	30	3.0	14	1.3	44	2.1
Visual Defect	89	xxx	103	xxx	192	38.4	89	xxx	103	xxx	192	16.5

NB. More than one disease found in 119 pupils.

Some individual diseases:

Heart Disease	Males 7	Females 1
Musculoskeletal	Males 2	Females 2
Imbeciles	Males 1	Females 0
Deafness	Males 1	Females 0
Trachoma	Males 1	Females 1
Tuberculosis (all)	Males 16	Females 13

1962.

Total boys examined . 1403 **Unhealthy** 558 **Percentage Unhealthy** 41.5

Total girls examined 1330 Unhealthy 623 Percentage Unhealthy 45.5

Total pupils examined 2733 Unhealthy 1181 Percentage Unhealthy 43.5

ANALYSIS OF DISEASE GROUPS.

Disease	Unhealthy pupils(total 1181, Refr.605)						All pupils(total 12733, Refr. 2157)					
	Boys (558)		Girls (623)		Total(1181)		Boys(1403)		Girls(1330)		Total(2733)	
	No	%	No	%	No	%	No	%	No	%	No	%
Anaemia	307	55.0	411	66.0	718	60.5	307	21.8	411	30.9	718	26.3
Ear/Nose/Throat	66	11.8	84	13.4	150	12.6	66	4.7	84	6.3	150	5.5
Mal-nutrition	34	6.0	8	1.2	42	3.6	34	2.4	8	0.6	42	1.5
Respira-tory	52	9.3	20	3.2	72	6.2	52	3.7	20	1.5	72	2.6
Skins	25	4.4	11	1.7	36	3.0	25	1.7	11	0.8	36	1.2
Visual Defect	77	xxx	94	xxx	171	28.2	77	xxx	94	xxx	171	7.9

NB. More than one disease found in 8 pupils.

Some individual diseases: (repeat diagnoses in several cases)

Heart Disease	Males 3	Females 3
Musculosketal	Males 3	Females 2
Imbeciles	Males 3	Females 0
Deafness	Males 2	Females 0
Tuberculosis(all)	Males 17	Females 7

1963.

Total boys examined 1545 Unhealthy 658 percentage unhealthy 42.6

Total girls examined 1558 Unhealthy 826 percentage unhealthy 53.0

Total pupils examined 3103 Unhealthy 1484 percentage unhealthy 47.8

ANALYSIS OF DISEASE GROUPS.

Disease	Unhealthy pupils(total 1484, Refr. 881						All pupils(total 3103, Refr. 2222)					
	Boys (658)		Girls (826)		All (1484)		Boys(1545)		Girls(1558)		All(3103)	
	No.	%	No.	%	No	%	No	%	No	%	No	%
Anaemia	398	60.5	551	66.7	949	63.6	398	25.7	551	35.3	949	30.5
Ear/Nose/Throat	59	8.9	87	10.5	146	9.7	59	3.7	87	5.5	146	4.6
Mal-nutrition	19	2.8	15	1.8	34	2.3	19	1.2	15	0.9	34	1.0
Respira-tory	30	4.5	20	2.4	50	3.4	30	1.9	20	1.2	50	1.5
Skins	30	4.5	21	2.5	51	3.5	30	1.9	21	1.3	51	1.6
Visual Defect	132	xxx	139	xxx	271	30.7	132	xxx	139	xxx	271	12.2

NB. More than one disease found in 17 pupils.

Some individual diseases. (repeat diagnosis in several cases).

Heart Disease	Males 6	Females 2
Musculoskeletal	Males 10	Females 4
Imbeciles	Males 3	Females 0
Deafness	Males 0	Females 0
Trachoma	Males 1	Females 0
Tuberculosis(all)	Males 10	Females 17.

Combining the above analysis, one obtains the following table representing the average annual incidence of diseases in the schoolchildren in the area:

Total boys examined 1314 Unhealthy 549 Percentage unhealthy 41.7

Total girls examined 1302 Unhealthy 640 Percentage unhealthy 49.0

Total pupils examined 2616 Unhealthy 1189 Percentage unhealthy 45.4

Disease	Unhealthy pupils (total 1189, Refr. 662)						All pupils (total 2616, Refr. 1847)					
	Boys (549)		Girls (640)		All (1189)		Boys (1314)		Girls (1302)		All (2616)	
	No	%	No	%	No	%	No	%	No	%	No	%
Anaemia	287	52.2	399	62.3	686	57.2	287	21.7	399	30.6	686	26.1
Ear/Nose/Throat	73	13.3	94	14.6	167	13.9	73	5.5	94	7.2	167	6.3
Mal-nutrition	35	6.3	15	2.3	50	4.3	35	2.6	15	1.1	50	1.8
Respiratory	48	8.7	29	4.5	77	6.6	48	3.6	29	2.2	77	2.9
Skins	28	5.1	15	2.3	43	3.7	28	2.1	15	1.1	43	1.6
Visual Defect	99	xxx	112	xxx	211	31.8	99	xxx	112	xxx	211	11.4

NB. More than one disease found in 48 pupils.

Some individual diseases: (to nearest whole number)

Heart Disease	Males 5	Females 2
Musculoskeletal	Males 5	Females 3
Imbeciles	Males 2	Females 0
Deafness	Males 1	Females 0
Trachoma	Male/Female: plus/minus 1	
Tulerculosis (all)	Males 14	Females 12

LEGEND:

Refr.	means refraction, ie. eye test using Snellens test chart only.
Anaemia:	1961 pallor of mucosae; 1962/63 Haemoglobin below 80%
Malnutrition:	Clinical evidence of deficiency diseases, excluding under-nutrition.
Respiratory:	Excluding tuberculosis.
Skins:	All types of skin disease.
Visual Defect:	All errors of refraction and opacity of refractive media, including inflammatory eye disease.

b) Ranking of Diseases.

Disease	1961			1962			1963			Average		
	Boys	Girls	All	Boys	Girls	All	Boys	Girls	All	Boys	Girls	All
Anaemia	1	1	1	1	1	1	1	1	1	1	1	1
Ear/Nose/ Throat	2	2	3	2	2	3	2	2	3	2	2	3
Mal-nutrition	4	4	5	4	5	5	5	5	6	4	4/5	5
Respiratory	3	3	4	3	3	4	3/4	4	5	3	3	4
Skins	5	5	6	5	4	6	4/3	3	4	5	5/4	6
Visual Defect	x	x	2	x	x	2	x	x	2	x	x	2

A composite chart, giving percentages and ranking for the whole school pupulation, i.e. boys and girls together, for the years 1961, 1962 and 1963, with the average for comparison, gives the following information:

Disease	1961		1962		1963		Average	
	Percent	Rank	Percent	Rank	Percent	Rank	Percent	Rank
Anaemia	19.4	1	26.3	1	30.5	1	26.1	1
Visual Defect	16.5	2	7.9	2	12.2	2	11.4	2
Ear/Nose/ Throat	10.3	3	5.5	3	4.6	3	6.3	3
Respiratory	5.4	4	2.6	4	1.5	5	2.9	4
Mal-nutrition	3.8	5	1.5	5	1.0	6	1.8	5
Skins	2.1	6	1.2	6	1.6	4	1.6	6

COMMENTS ON THE ABOVE ANALYSES.

Anaemia: The incidence rose from 19.4% in 1961 to 30.5% in 1963. This was probably due to my increasing experience in spotting these cases.

Visual Defect: The percentage fell from 16.5 in 1961 to 12.2 in 1963; in 1962 it had been under ten percent. This is due to two factors. In 1961 all pupils from standard one up had eye tests, as I expected the average child to be able to read letters and thus a Snellen chart after two years of schooling. Towards the end of 1961 I found out that the majority of pupils in standard one could not read at all. The occasional one who could read was registered as either normal or defective vision as the case might be, but all those who could not read were, in 1961, registered as errors of refraction. This brought the numbers up disproportionately for that year. In 1962 and 63 only pupils in standard one who could read properly were tested; routine eye testing was done from standard two up only. Those in standard two who could not read (and there were quite a few) were not registered at all; in such cases the eye test was deferred for one year.

Secondly, with increasing experience of these pupils. I allowed in 1962 and 63 for natural errors, and did not expect the children to read 100% correctly. In 1962 I was probably a little too lenient after the 1961 experience, which accounts for the low percentage in 1962; I then became more strict again in 1963. The figures for 1962 and 63 must therefore be regarded as a more true reflection than those of 1961. With regard to the standard of visual acuity, 6/6 in an eye was regarded as normal.

Ear/Nose/Throat, and Respiratory: The high figures for 1961 are due to the fact that all pupils were examined in the spring, when the incidence of ear, nose, throat, and respiratory infections is at its highest in Swaziland. In 1962 and 1963 the examinations were spread more evenly over the whole year, and thus the numbers are lower.

Malnutrition: The incidence of this is also highest in 1961, again due to the fact that the examinations were made in the spring. At that time of the year the people's stores of food are at their lowest ebb, storage bins are empty, and most of them cannot afford to buy sufficient food from the stores. It must be emphasised that the term malnutrition as used here means literally wrong feeding, ie. a qualitative rather than a quantitative deficiency. It is not synonymous with undernutrition, which is discussed in detail later, and which is taken to mean a quantitative deficiency.

Comparing my Swaziland figures of 45% unhealthy pupils with some figures from the United Kingdom and the USA,[1, 2] we find that in Britain in 1956/57 fifteen percent of school entrants were

found to have defects requiring treatment. Incidentally, those actually getting treatment were about 50% in Hertfordshire, 20% in Plymouth, and 12½% in Liverpool.

A comparison of the incidence of certain defects in British (England and Wales) schoolchildren and in Swazi schoolchildren is given in the following table. British figures have been converted from "incidence per thousand examined" to percentages.

	British schoolchildren (England and Wales)				Swazi schoolchildren
	1959	1961	1963	Average	Average 1961, 62, 63
Skin Disease	2.71	3.02	3.02	2.9	1.6
Visual defects	11.43	12.44	12.94	12.3	11.4
Squint	1.96	1.87	1.92	1.9	x
Otitis Media	1.15	1.19	1.26	1.2	0.05
Heart Disease	1.27	1.31	1.39	1.3	0.3
Lungs (incl. TB.)	2.46	2.31	2.43	2.4	2.9 (excl. TB)
Hernia	0.32	0.32	0.34	0.3	x

In the United States of America a Joint Committee on School Health Services (American Medical Association and National Education Association) reported in 1953 (published in 1954) on the incidence of some diseases in American schoolchildren. They gave the incidence as so many cases per thousand; for comparison with my figures I have converted these to percentages.

	American	Swazi
Blind or partially sighted	0.2	0.01
Deaf or hard of hearing	1.5	0.04
Speech defects	1.5	x
Crippled	1.0	0.3
Delicate	1.5	x
Epileptic	0.2	0.03
Mentally retarded	2.0	0.09

At the end of every school year I gave a lecture to the assembled head teachers of all the schools taking part in the school health service, and for ready reference and popular comsumption and transmission to pupils and parents I would summarise my findings as follows: "Of every hundred children in your school forty-five are unhealthy. They will between them be suffering from fifty different diseases, which means that some of the children will have more than one disease. We are likely to find

Anaemia in 26 pupils (roughly a quarter)
Defective vision in 11 (roughly a tenth)
Disease of the ear, nose and throat in 6 or 7
Chest catarrh in 3
Malnutrition in 2
Skin Disease in 2
and 25 will be small for their age because they do not get enough to eat.

All the above are troublesome diseases; can any parent or teacher be surprised if the children do not benefit by what you are trying to teach them?"

The percentage incidence of the different diseases is shown in graph 4.

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(E) DIFFERENT DISEASES IN DETAIL.

1) ANAEMIA. This was the most common disease encountered among our schoolchildren in Swaziland. In 1961 there were 393 anaemic pupils of both sexes, 19.4% of the population; this rose to 718 (26.3%) in 1962 and 949 (30.5%) in 1963. The average number of cases for the three years was 686 or 26.1%. Anaemia ranked first every year, and also in the average, among diseases of the school-going population, if one excluded undernutrition, which is here not regarded as a "disease."

The high incidence of anaemia is a surprising finding; most other observers whom I have been able to read up regard anaemia, and especially iron deficiency anaemia (into which group many of my cases fell) as very rare in Africans in Southern Africa. The Staff of the Paediatric Department of Baragwanath Hospital [1] state that mild normochromic anaemia is fairly common in Kwashiorkor, but they make

no mention of iron deficiency anaemia. R. Cassel and J. Metz [2] state that idiopathic hypochromic anaemia is not rare (in Bantu hospital patients); during a two year period they encountered 117 cases, 90 in infants and 27 in adults, but they do not give the percentage incidence.

K. J. Keeley states that iron deficiency anaemia is extremely uncommon in the Bantu. [3] Th. Gerritsen and A. R. P. Walker found, in groups of Bantu adults from all parts of Southern Africa,

a) an unusually high iron intake,
b) frequent siderosis,
c) rarity of hypochromic anaemia,
d) elevation of serum iron levels and total iron binding capacity. [4]

In another publication A. R. P. Walker [5] states: "In Bantus, excessive iron intake results in widespread siderosis, elevated serum iron concentrations, and a low incidence of hypochromic anaemia. Satisfactory haemoglobin levels are often maintained in grossly malnourished pellagrins..... Provided the iron reserves be excessively high, the other dietary haemopoietic factors are of much less importance."

"Iron intake in the South African Bantu often exceeds 100 mg per diem, and occasionally reaches or even exceeds 200 mg per day. Iron vessels plus the particular diet of the Bantu permit the ingestion of this excessively high iron intake. Most of the adventitious iron is inorganic in character, and therefore readily available for absorption..... As would be expected , the high intake and siderosis influence certain blood values. There is now a good deal of data, some published, more unpublished, indicating that iron deficiency among these people (South African Bantu) is less common than among any other non-White population upon which data have been reported. This relationship is understandable, since Rath and Finch have shown that body iron excess cannot coexist with iron deficiency anaemia..... Serum iron values are frequently elevated in both hospital and non hospitalised Bantu populations." [6]

In the light of the above statements by experienced observers, my findings in Swazi schoolchildren are unusual.

a) Clinical Diagnosis. This was based on pallor of the conjunctiva and/or the tongue, as noted during the routine physical examination. Many observers regard this as an unsatisfactory method of diagnosing anaemia, as capillary blanching in normal subjects may give the impression of anaemia. In 1961 no haemoglobin checks were done, as there was no time for this essential examination, but in 1962 and 63 all clinically anaemic pupils had a haemoglobin check. The incidence of anaemia with haemoglobin checks was higher in these years than in 1961. It would therefore appear that, at least in the present study, pallor of the mucosae was of some use in diagnosing anaemia.

b) Haemoglobin estimation. In view of the large number of clinically anaemic pupils it became essential to do a haemoglobin test on every suspected case. This was started in 1962. The problem was which method to use; the ordinary apparatus was fragile and would certainly be broken on these journeys, and the Haldane and Sahli tests took so much time that one observer alone would not be able to do more than a fraction of these required. The Sahli method was the routine one used in our hospital, but for rapid checks at clinics we used the Talquist paper method. Much criticism has been directed at this method; some observers state that errors of up to 50% are usual when this method is used. During November and December 1961, therefore, I campared the results of the Talquist papers with those obtained by the Sahli acid haematin method. The trial was made blindly, blood specimens being sent to the hospital laboratory labelled with a number only. Results were recorded against the numbered specimens; I had no clue to the identity of the patients, from some of whom two or three specimens were submitted on the same day. In 50 specimens thus examined by the two methods, it became obvious that there was close agreement between the results, the difference between the Talquist and the Sahli method being no more than 10%. I therefore decided to use the Talquist method at the schools. Another check was possible later; all pupils who had a low haemoglobin by the Talquist method were asked to come to the Mahamba hospital for treatment. 172 pupils did in fact come for treatment; in every case the Talquist reading was checked against a Sahli reading, without my being aware of the previous Talquist result. Again close agreement was noted, the error being in the region of 10%. I feel sure, therefore, that the haemoglobin values registered in this survey are reasonably accurate. Only Talquist papers made by one single firm were used, and the method was identical in each case. A drop of blood was taken from the left thumb of the pupil, transferred on to the paper, and the result read after 30 seconds, in daylight but not in direct sunlight.

The haemoglobin results for 1962 and 63 have been pooled, and are:

Total pupils clinically anaemic	2060
Haemoglobin tests done on	1 680
Haemoglobin below 80% in	1601, ie. 95.3%

It was not easy to decide on a "normal" haemoglobin level for these children. All observers agree that in children the haemoglobin level is below the adult normal, but different authors do not agree as to what these values are in children, and when they change. Trowell, in his "Non Infective Disease in Africa" (1960) says on page 376 that after the first year of life there is a slow rise in haemoglobin from 11 G/100 ml to higher figures; adult levels are reached only after adolescence. Garrod, Batten and Thursfield in their "Diseases of Children" (1953) state that, after the first year, on a mixed diet, the Hb should reach 90-100% of the adult normal (13-14.8 G %), with minor fluctuations about puberty. Nelson, in his "Textbook of Pediatrics" (1959) on page 932 gives the Hb at 8-12 years as 14.1 G % (or 90% of normal, where normal is 15.6 G %); on page 1403 of the same work, Hb above ten years is given as 14-16 G/100 ml. Whitby and Britten, in "Diseases of the Blood" (1963), give the haemoglobin up to puberty as 12.5-13.8 G %, and thereafter as 13.8-17 G %.

In African practice these "European" values are used;however,as our children were aged 6-18 years,no single Hb value would be "normal" for all age groups.Eventually I decided to regard a haemoglobin below 80% Talquist or Sahli as evidence of anaemia.

Tabulated haemoglobin percentages.

Hb percentage	Talquist		Sahli 100% = 14G.	
	Pupils	Percent	Pupils	Percent
Less than 49	nil	0	nil	0
50-59	208	12.4	27	15.7
60-69	836	49.7	70	40.7
70-79	557	33.1	66	38.3
80-89	55	3.2	9	5.2
90-100	24	1.4	nil	0
	1680	99.8	172	99.9

Mean (arithmetical average) Haemoglobin percentage

68 (S. D. 7. 8) -68 = 9. 5G.

(S. D. 9. 2. ie. 1. 2G)

c) Age/sex specific distribution of anaemias.

A total of 1493 pupils has been analysed. This is less than the total number of anaemic pupils; the discrepancy is due to the fact that when any doubt was felt about the real age of the pupil, he or she was omitted from the table. Such doubt arose at all ages, but particularly in the 10 and 16 year groups both in boys and in girls. In addition, all anaemic pupils who did not have a haemoglobin test were omitted.

Boys				Girls				Total			
Age	Number	Anaemia	%	Age	Number	Anaemia	%	Age	Number	Anaemia	%
6	58	8	13.8	6	93	15	16.1	6	151	23	14.9
7	168	42	25.0	7	223	64	28.7	7	391	106	26.8
8	187	56	29.9	8	278	85	30.6	8	465	141	30.2
9	221	52	23.5	9	259	78	30.1	9	480	130	26.8
10	230	64	27.8	10	245	104	42.4	10	475	168	35.1
11	218	63	28.9	11	209	86	41.1	11	427	149	35.0
12	297	86	28.9	12	301	119	39.5	12	598	205	34.2
13	211	77	36.5	13	193	111	57.5	13	404	188	47.0
14	197	65	33.0	14	176	76	43.1	14	373	141	38.0
15	162	66	40.7	15	120	58	48.3	15	282	124	44.5
16	123	23	18.7	16	78	39	50.0	16	201	62	34.3
17	86	13	15.1	17	36	17	47.2	17	122	30	24.6
18	74	21	28.3	18	21	5	23.8	18	95	26	26.1

Therefore of 2231 boys, 636 or 28.5% were anaemic

of 2232 girls, 857 or 38.5% were anaemic

and of 4463 pupils, 1493 or 32.1% were anaemic.

From the above tables it appears that in both sexes, and in the group as a whole, the incidence of anaemia increases with increase in age up to 15 years. There is a more than 75% increase in the incidence from six to seven years. The period of the greatest incidence of anaemia in boys is from 13 to 15 years, while in girls it is from 10 to 17 years. The reasons for this are obscure; in girls it does not seem to be related to the menarche, which occurs during the 14th year.

ADDENDUM: Statistical analysis shows that the differences in the incidence of anaemia in boys and girls are not very significant. At 12 degrees of freedon, P lies between 0.10 and 0.05; hence differences are probably due to chance alone.

Finally, the overall picture is that of a mild anaemia, with an average haemoglobin of 68%. Only 12.4% of pupils had a haemoglobin below 60%.

d) Investigation of Individual Patients.

Out of the 1601 pupils found to have a haemoglobin below 80%, 172 reported to Mahamba Methodist Hospital for further check up and treatment. Haemoglobin tests were repeated on all these, using the Sahli haemoglobinometer (acid haematin method) and all were again found to have a low haemoglobin, in good agreement with the Talquist reading. Their previous haemoglobin readings were not known to me; only after the Sahli reading had been obtained were they looked up in the book. Thereafter each pupil had a bloodsmear prepared.

i. Blood Smear. These were the ordinary thin smears; they were allowed to dry in the air and were then stained with Leishmans stain as follows:

5 - 10 drops of stain left on for one minute,
10-20 drops of distilled water left on for $7\frac{1}{2}$ minutes.

The stain was then washed off with distilled water, which was left on for a further minute. The smears were then dried in the air and examined under the oil immersion lens.

Elaborate subdivision was not attempted, as both equipment and experience were lacking. A simple subdivision was made into the groups normocytic, hypochromic, macrocytic, and dimorphic. In addition any special features were noted.

Criteria.		
	Normocytic normochromic	more than 70% of cells normocytic normochromic
	Normocytic hypochromic	more than 30% of cells hypochromic
	Macrocytic	more than 30% of cells macrocytic
	Dimorphic	Normocytic/Hypochromic/macrocytic cells in approximately equal proportions (about 30% of each type).

Results. Total smears examined 172; boys 44, girls 128.

	Males (44)		Females (128)		Total (172)	
	Number	%	Number	%	Number	%
Normocytic normochromic	20	45.5	68	53.1	88	51.1
Normocytic hypochromic	22	50.0	43	33.6	65	37.7
Macrocytic	0	0.0	7	5.5	7	4.0
Dimorphic	2	4.5	10	7.8	12	7.0
Malaria parasites	0	0.0	2	1.5	2	0.7
Target cells	0	0.0	1	0.8	1	0.4
Eosinophilia (above 30%)	0	0.0	2	1.5	2	0.7

The two pupils showing malaria parasites were both symptomless; the two pupils showing eosinophilia had no stool or urinary parasites.

Comments: For the overall picture it is best to discuss both sexes together. Normocytic normochromic and hypochromic anaemia together made up over 80% of the total. The macrocytic and dimorphic anaemias make up 11% of the total, a not inconsiderable percentage in this young population.

ii. Bilharzia. Severe bilharzial infestation, due to loss of blood in the urine and the stools, may give rise to significant anaemia in affected people; this anaemia is usually normochromic or hypochromic. In the present survey it was not possible to do urine microscopy on every anaemic pupil; it was therefore decided to examine only the urines of those who reported for check haemoglobin and further treatment. A test for occult blood was done in the absence of macroscopic haematuria, and where this test was positive microscopy was carried out. Of the 172 urines examined, twelve (12) were bilharzia positive; of these eleven (11) showed red blood cells and ova, while one (1) had red blood cells only, without ova, but no other abnormal urinary cells. This gives 7% positive urines among the anaemic pupils. Stool examinations were not done in any of them, due to the unwillingness of these children to submit specimens.

In order to get a more reliable idea of the incidence of bilharzia in the population of this area, all urine microscopies done by myself during 1961, 62 and 63 were analysed, excluding the urines of anaemic schoolchildren.

Results: Total specimens 533

Bilharzia positive (RBCs and ova)	30	ie.	5.6%
Bilharzia probables (RBCs, no ova)	22	ie.	4.1%
Haematuria (other causes)	13	ie.	2.4%

Therefore, with 7% bilharzia positives in the anaemic pupils and a maximum of 9.7% positives in the general hospital population, bilharzia accounts for less than 10% of cases of blood loss in our area.

To complete the picture, all stools examined by myself during the years 1961, 62 and 63 were also analysed, to see what percentage had blood in the stools, either frank or occult blood.

Results. Total specimens 652

Bilharzia positive (ova) 4 ie. 0.6% (mansoni 3, haematobium 1)
Blood (occult or naked eye) 63 ie. 9.8%
Amoeba positive 22
No parasites or ova 40
Hookworm 1

The incidence of intestinal bilharzia is therefore well below 1% in the general hospital population of the area, of whom the schoolchildren form a fairly representative cross section.

e) Treatment. Pupils were treated according to their slide results. Normochromic and hypochromic anaemia was treated by an iron mixture and vitamin C. The course lasted two weeks. Dose, regardless of age, was Ferric ammonium citrate gr 20 three times daily, and vitamin C 100 mgm every morning.

Total dose of iron: 840 grains or $1\frac{3}{4}$ oz (56 G)
Total dose of Vitamin C: 1400 mg (1.4G)

Macrocytic and dimorphic anaemias were treated with a proprietary ethical preparation containing B^{12} and folic acid.

Results: Of the 172 pupils put on treatment, only 33 reported again for a haemoglobin check and repeat blood smear examination after completion of treatment. Of these 33 I had found normocytic normochromic anaemia in 25, normocytic hypochromic anaemia in 5, macrocytic anaemia in 2, and dimorphic anaemia in 1.

Of the group of 30 normochromic and hypochromic anaemias, all had responded to treatment; in all cases repeat haemoglobin was above 95% Sahli, exept in one pupil whose repeat haemoglobin was 85% (his previous haemoglobin had been 65%). One pupil with macrocytic anaemia and one with demorphic anaemia had been given iron and vitamin C by mistake; there was no rise in their haemoglobin levels. Both were then given iron-vitamin B^{12} -folic acid capsules, but were lost to follow-up. One pupil with macrocytic anaemia was given the correct treatment from the start, and her haemoglobin rose from 65 to 100%.

f) Conclusions. The high incidence of anaemia in a population not heavily infested with parasites contradicts the recorded opinions of practically all other observers I have been able to read up. The only comparable report I know of so far is that of Squires[7]. In 1945 he did a series of haemoglobin estimations in Swazi children as part of a nutrition survey. In 181 pupils of both sexes he found a mean haemoglobin of 11.1G per cent (SD 1.33). This is much higher than my average of 9.5G per cent (68% Sahli). A difference of 1.6G haemoglobin is either due to a gross error or is very significant. Following my reports of the high incidence of anaemia in Swazi schoolchildren, the Director of Medical Services of the Swaziland Government started an investigation into this problem at Mbabane; his preliminary communication to me supports my findings.[8]

During 1964, 207 children were examined at two Mbabane schools, in Northern Swaziland. All were in Grades I and II; their ages are not given. Mbabane is not a malarious area; the incidence of bilharzia in these children is not known. Of the 207 children examined, 56 had a haemoglobin below 80% Talquist, giving an incidence of anaemia of 27.05 percent.

The Swazi people, like other Bantu groups in Southern Africa, have an adequate dietary iron intake, and iron cooking vessels are universally used. The question is whether they can utilise this iron for haemopoiesis; serum iron estimations will be an essential first step in any future enquiries into this problem. While it is obvious that we are dealing with a dyshaemopoietic anaemia, the reasons for its occurrence and the remedies to be applied must await the results of further investigations by other more competent and better equipped observers. All I can fairly claim is that a problem has been defined; the solution should not be beyond the powers of an experienced haematologist.

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2) NUTRITIONAL STATUS.

a) Nutritional Habits.

These have been well described by Miss S. Jones in her investigation of Swazi nutrition[1]. She dealt with the population as a whole, of which schoolchildren formed only a small part. In our schoolchildren nutritional habits varied widely; some few ate a Westernised diet, while others lived on the traditional Swazi diet. The majority ate a mixture of Western and Swazi foods. The basis was the traditional Swazi diet, but extras were European foods.

The basic Swazi diet at present consists chiefly of cereals, maize being the staple food. Sorghum is eaten in areas where it is grown, but its cultivation is not practised on a large scale. Meat is eaten when it is available; there are strong traditional influences at work in sharing it out. Men get the choicest pieces, older women the next best, and children mostly the scraps. Swazi dietary practice does not know the concept that growing children need relatively more and better food than fully grown adults. Meat is expensive; rarely do the Swazi slaughter their cattle for food, and most meat has to be bought. Fish is rarely eaten by the Swazis, chiefly on account of tribal misconceptions. Thus a source of valuable protein is missed. Eggs are also rarely eaten; they are said to be bad for females, both young and old, and every egg is in addition regarded as an additional fowl to be eaten later. Fowls are not as plentiful as they might be, for a large percentage of chickens succumb to disease. Where fowls are available, however, they are eaten, but more as an additional delicacy than as a food. Vegetables are eaten where they grow wild; rarely are vegetables grown in Swazi gardens, and where this does happen they are mostly sold for cash on the market.

The traditional Swazi diet, consisting chiefly of meat, maize and beer, was well-balanced and nutritious, but it has to a large extent been given up. European foods have become popular among the people, often as additional foods; the most popular are bread and cakes and biscuits. Of these, only bread is eaten in large quantities, for its satiety value; among the more sophisticated strata of the community white bread is preferred to brown.

On the whole, Swazi children attending mission schools are members of the more privileged sections of the community, and their parents are usually fairly enlightened individuals. The diet of these children was, as far as I could ascertain, based on maize products, supplemented by meat once or twice a week, with bread added to the diet as a snack between meals. Some of the better-class pupils came from homes where three meals a day were eaten, but the great majority ate only twice a day, in the morning and in the evening. A few had the traditional one meal a day regime.

Over 90% of the pupils questioned had had something to eat before they set out for school in the morning. This question had to be phrased carefully. If they were asked "Did you have a meal before you came to school today?" the answer was in the negative in almost all cases. If one asked "Did you have something to eat before you came to school today?" the answer was in the positive in nearly all cases. The difference here is between a meal and something to eat. A meal to a Swazi child means the main meal of the day, eaten in the evening; the whole family assembles for this meal. Such a meal is a lengthy affair, the food for which has taken almost the whole day to prepare. "Something to eat" is a different matter, consisting of anything one eats to satisfy the pangs of hunger, mostly leftovers from a previous meal or some snack or other. It is therefore evident that very few of our schoolchildren left home with their stomachs empty. Schoolboys consider it unmanly to carry food to school, just like their elders consider it unmanly to carry food; this task is left to girls and women. Therefore not a single schoolboy would admit that he brought something to eat to school with him, but the great majority of girls carried lunch to school; some girls even sold their lunch to hungry schoolboys.

Whether the children ate enough in the morning before they left for school was not possible to establish. Getting to school is a big physical effort for most pupils. The minority live close to the schools; the majority walk or cycle from three to five miles from their homes to the schools. Energy expenditure is therefore likely to be considerable and in the absence of an adequate breakfast it is understandable that many children are already tired out when they reach their school. In the time at my disposal it was not possible for me to assess the adequacy or otherwise of the diet consumed, but from my superficial knowledge I am in agreement with Jones whose summing up is that the Swazi diet is deficient in calories, calcium, vitamin A, riboflavin and niacin. These deficiencies are seasonal and regional. [2]

b) Undernourished Pupils.

In this thesis, undernutrition has been distinguished carefully from malnutrition. Undernourished children are those who do not get enough to eat, regardless of any evidence of vitamin deficiency, while malnourished pupils are those in whom there is lack of balanced feeding, ie. a qualitative deficiency. A pupil may of course be both malnourished and undernourished; this section deals with undernourished pupils only, ie. those children who were ten percent or more below average height and/or weight for their age. It must be remembered that height and weights were obtained by measuring, weighing and recording all pupils of whose ages I was sure, including those who were ill; my average heights and weights might therefore well be too low for the different age groups. If one had measured healthy pupils only, the averages would probably have been higher, and in that case the percentage of undernourished pupils would also have been higher.

In the determination of the features and the stature of the human body, environment as well as nutrition plays a part. Small mothers tend to have small babies; nutrition and environment affect the size and development of the individual in utero, as well as the extra-uterine existence.[3] Body size results from a number of factors such as inherited traits, birth weight, and past nutritional experience, while present nutritional factors affect the rate of growth.[4] All the above observations must be taken into account in the study of the tables which follow.

A Table of the Incidence of Undernutrition in Swazi Schoolchildren.

BOYS.

Age (years)	Number	10% or more below average							
		Height only		Weight only		Height and Weight		Total	
		No.	%	No	%	No	%	No	%
6	60	0	0	14	23.3	2	3.3	16	26.9
7	186	3	1.6	37	19.9	12	6.4	52	27.9
8	232	7	3.0	37	15.9	12	5.2	56	24.1
9	260	0	0	55	21.1	6	2.3	61	23.4
10	282	0	0	61	21.2	3	1.0	64	22.2
11	265	1	0.4	52	19.6	8	3.0	61	23.0
12	334	5	1.5	91	27.2	7	2.1	103	30.8
13	251	0	0	54	21.5	12	4.7	66	26.2
14	219	1	0.4	53	24.2	6	2.7	60	27.3
15	184	0	0	47	25.5	1	0.5	48	26.0
16	145	0	0	30	20.7	0	0	30	20.7
17	109	0	0	18	16.5	1	0.9	19	17.4
18	87	0	0	12	13.8	0	0	12	13.8

GIRLS.

Age (years)	Number	10% or more below average							
		Height only		Weight only		Height and Weight		Total	
		No	%	No	%	No	%	No	%
6	93	1	1.0	28	30.1	0	0	29	31.1
7	251	4	1.5	57	22.7	12	4.7	73	28.9
8	343	2	0.6	68	19.8	5	1.4	75	21.8
9	335	0	0	69	20.6	5	1.5	74	22.1
10	286	2	0.7	58	20.2	6	2.1	66	23.0
11	238	1	0.4	53	22.2	10	4.1	64	26.7
12	338	1	0.3	80	23.6	7	2.0	88	25.9
13	238	1	0.4	59	24.7	3	1.2	63	26.3
14	207	3	1.4	45	21.7	4	1.9	52	25.0
15	143	0	0	29	20.2	3	2.1	32	22.3
16	85	0	0	27	31.7	0	0	27	31.7

Statistical analysis shows that the difference in the incidence of undernutrition in boys and girls is not significant. At 10 degrees of freedom P lies between 0.96 and 0.98; hence the differences are probably due to chance alone.

BOTH SEXES. (Combination of above tables).

Age (years)	Number	10% or more below average.							
		Height only		Weight only		Height and Weight		Total	
		No	%	No	%	No	%	No	%
6	153	1	0.6	42	27.4	2	1.3	45	29.3
7	437	7	1.6	94	21.5	24	5.5	125	28.6
8	575	9	1.5	105	18.2	17	2.9	131	22.6
9	595	0	0.	124	20.8	11	1.8	135	22.6
10	568	2	0.3	119	20.9	9	1.6	130	22.8
11	503	2	0.4	105	20.8	18	3.5	125	24.7
12	672	6	0.9	171	25.4	14	2.0	191	28.3
13	489	1	0.2	113	23.1	15	3.0	129	26.3
14	426	4	0.9	98	23.0	10	2.3	112	26.2
15	327	0	0	76	23.2	4	1.2	80	24.4
16	230	0	0	57	24.8	0	0	57	24.8

Therefore, of 2614 boys weighed and measured, 648 or 24.7% were ten percent or more below the average height and/or weight for their age;

of 2557 girls weighed and measured, 643 or 25.1% were ten percent or more below the average height and/or weight for their age;

and of 5171 pupils weighed and measured, 1291 or 24.9% were ten percent or more below the average height and/or weight for their age.

From the above tables it is also evident that weight is a much more reliable indicator of undernutrition, past or present, than is height alone.

A closer analysis of the undernourished children shows that of the 648 undernourished boys 156 of 24% were twenty percent or more below average weight for their age; of the 643 undernourished girls 206 or 32% were twenty percent or more below average weight for their age.

Tabulated figures show:

Age (years)	Boys			Girls			Both		
	a	b	Percent	a	b	Percent	a	b	Percent
6	16	1	6.2	29	6	20.7	45	7	13.4
7	52	7	13.4	73	17	23.3	125	24	18.3
8	56	11	19.6	75	27	36.0	131	38	27.8
9	61	10	16.4	74	23	31.0	135	33	23.7
10	64	17	26.5	66	30	45.4	130	47	25.9
11	61	23	37.7	64	13	20.3	125	36	29.0
12	103	24	23.3	88	36	40.9	191	60	32.1
13	66	28	42.4	63	26	41.2	129	54	41.8
14	60	18	30.0	52	18	34.6	112	36	32.3
15	48	11	22.9	32	6	18.7	80	17	20.8
	156	648	24.0	206	643	32.0	362	1291	28.0

In the table, column a shows the number of undernourished pupils in an age group, while column b shows the number of these who were 20% or more below average weight.

In the total figures for undernutrition, we found 24.7% of boys and 25.1% of girls undernourished; since, of these, 24% of boys and 32% of girls are twenty percent or more below their average weights for their age, we find for all the children that in round figures six percent of boys, eight per cent of girls, and seven percent of all pupils are twenty percent or more below the average weight for their age. This makes the whole matter much more serious, and suggests undernutrition on a grand scale.

The percentages of undernourished pupils are shown in Graph 5.

REFERENCES:

1, 2) Jones, S., "A Study of Swazi Nutrition". Institute for Social Research, University of Natal, Durban. 1963. Pages 121-168.

3) Wadsworth, G.R., "The Theory and Practice of Public Health". Oxford University Press, 1961. Page 83.

4) Ibid. Page 90.

c) Frank Malnutrition.

This was diagnosed, regardless of the height and weight, if evidence was found of a specific single or multiple deficiency disease. Malnutrition in the past, for example, healed rickets, was not included; the pupil had to show evidence of a specific deficiency disease at the time of the medical examination. I looked for definite evidence of pellagra and scurvy. Vague symptoms and signs, which are not generally accepted as being diagnostic of malnutrition, such as gynaecomastia, and the buccal frieze, were disregarded. Similarly, no assessment was made of the nutritional state as shown in the teeth; this would need an experienced and competent dentist. Phrynodermia was regarded as of malnutritional origin only if of recent development, ie. if it had developed during the preceding twelve months. None of the phrynodermia cases satisfied this criterion.

No cases of scurvy were seen; all the malnutritional disease diagnosed was due to lack of vitamin B complex factors. These cases could be divided into three groups:

1) those showing malnutritional cheilitis or stomatitis
2) those showing frank pellagra
3) those showing a combination of 1) and 2).

During the three years of the school health service, 153 cases of malnutrution were diagnosed, 107 boys (70%) and 46 girls (30%). Tabulation shows:

Disease	Boys	Girls	Total	Percent
Malnutritional Cheilitis	92	26	118	77.2
Frank Pellagra	4	12	16	10.4
Stomatitis/glossitis	11	8	19	12.4
	107	46	153	100.0

These figures show that the incidence of malnutrition in girls is less than half that in boys. In both boys and girls malnutrition presented most commonly as malnutritional cheilitis. Frank pellagra accounts for 26% of malnutrition in this sample of girls, while only 3.7% of boys presented as pellagra.

Compared with the high incidence of undernutrition, (24.9% of the population), malnutrition must be regarded as of relatively minor importance, the incidence over three years being only 2%. The other publications I have been able to consult, and from which I quote in this thesis, do not distinguish between malnutrition and undernutrition. In

the present series of malnourished pupils of both sexes, 37 children, ie. 24.1%, were also undernourished, that is, ten percent or more below average height and/or weight for their age.

d) Association of Undernutrition and Anaemia.

Undernutrition and anaemia were the two most common abnormalities found in our schoolchildren in Swaziland. With regard to the anaemia, the data at my disposal were not sufficient to determine the probable cause of this condition, though there is a strong suspicion that it might be nutritional in origin. It was therefore thought to be of interest to examine the incidence of anaemia in undernourished children and compare this with the incidence of anaemia in all children.

Of the 648 undernourished boys, 264 or 41% were also anaemic; Of the 643 undernourished girls, 401 or 62% were also anaemic, and of the total of 1291 undernourished children, 665 or 51.5% were also anaemic.

Tabulating these percentages, and comparing them with those of the general school-going population, we find:

Percentage of ALL pupils anaemic.			Percentage of UNDERNOURISHED pupils anaemic.		
Boys	Girls	All	Boys	Girls	All
28.5	38.3	32.1	41.0	62.0	51.5

Statistical analysis shows that the differences in the percentage incidence of anaemia between undernourished and all groups of children are significant. In the case of boys, P = 0.10, which is of moderate significance; in the case of the girls P = 0.05, which is of definite significance, and for the groups as a whole P = less than 0.05. As these differences are unlikely to be due to chance, an explanation must be sought for them.

Even without statistical treatment these differences are too great to be ignored. It is difficult to find a reason for this high incidence of anaemia in undernourished children. Several explanations can be offered, of which none is really convincing. One could argue that in anaemia the appetite is poor, so that these children eat less and thus become undernourished. It is also possible that deficiency of nourishing foods also means deficiency of haemopoietic factors in the diet, thus leading to anaemia. In view of the adequate iron intake of the Swazis, iron deficiency is unlikely, unless the ingested iron is not absorbed and/or metabolised. This, however, on the evidence of other observers, would seem to be unlikely. There yet remains the possibility that both the undernutrition and the anaemia are caused by lack of factors or substances needed for both good nutrition and adequate haemopoiesis. Red blood cells are essentially protein discs containing Haemoglobin, and

haemoglobin itself also contains protein. It is therefore conceivable that lack of protein will also inhibit adequate haemopoiesis, though the common experience is that in protein malnutrition in children the anaemia is normocytic normochromic, while nearly half of my children were in the hypochromic category. None of the above explanations amount to much more than surmise, and this problem of the high incidence of anaemia is undernourished schoolchildren obviously needs to be investigated much more fully and carefully than I was able to do. To the best of my knowledge this problem has so far not been raised by other observers.

e) Discussion and Comments:

The nutrition of the Swazi people has in the past been studied by numerous observers; the most comprehensive and detailed study was the Nutrition Survey undertaken by Miss S. Jones, B.Sc., M.S. in 1961/2.[1] In none of the reports available to me, not even in Jones' work, is a distinction made between undernutrition and malnutrition. Swazi nutrition is a sub-division of Bantu nutrition as a whole; there are overall similarities and individual differences.

A.R.P. Walker[2], writing about Bantu nutrition, says inter alia "The gross protein intake of the South African Bantu is approximately adequate on the 1 G/kg basis.....the fact is that a low total protein intake is not characteristic" (underlining mine, italics Walker).

Jones, in her publication covering all sections of the Swazi population, found the diet deficient in calories, calcium, vitamin A, riboflavin and niacin; these deficiencies were both regional and seasonal. Examining 293 children, and re-examining 242, she based her diagnosis of malnutrition on a constellation of signs of deficiency, not on any single sign. Jones found the greatest incidence of malnutrition in the 1-4 years age group, and the greatest but one in the 7-12 year age groups in both sexes. This latter group includes a number of schoolchildren, but it is not stated what percentage of the group these represented. In a table showing the distribution of cases examined clinically, Jones[3] divides the children into

a) those examined once only

b) those re-examined.

For the purpose of this thesis, I have combined her columns a) and b), giving the following table:

Age Group (in years)	Sex	Number of Cases	Percentage affected	Laufer's figures
1 - 4	M	67	14.97	X
	F	91	9.36	X
7 - 9	M	50	12.15	25.1
	F	42	9.70	24.2
10 - 12	M	41	9.62	25.3
	F	40	9.16	25.2
13 - 16	M	26	6.20	25.0
	F	41	6.20	26.3
17 - 19	M	12	4.17	X
	F	11	4.64	X

Children under 1 year and 5-6 years old are also given in Jones' table, but I have omitted these from this table as I have no figures of my own for comparison.

My percentages refer only to undernourished children and exclude malnourished ones, except 37 pupils who were malnourished as well as undernourished. Jones' figures refer to malnutrition as a whole and do not distinguish malnourished from undernourished. My figures are therefore not comparable to hers. If one assumes that her malnourished pupils also include undernourished ones, her percentage of malnourished children is much lower than mine in all age groups.

S. Selby, in 1945, examined well over a thousand children in Swaziland to assess their state of nutrition and health[4]; his criteria and standards are not given, but he visited all areas of Swaziland and examined children in Southern Swaziland also, viz. at Goedgegun Clinic, Hlatikulu and Hluti. A summary of his general impressions is as follows:

With a few notable exceptions, the standard of nutrition as shown by the state of health of the children was low;

The main defects appeared to be in proteins and fats;

The girls appeared to be better nourished than the boys·

the worst examples of malnutrition were in the preschool age;

the dental condition of many of the children was poor;

In the Southern districts he found evidence of gross healed rickets. This was rather unexpected, as in the Northern districts little evidence of

rickets was noted; at most schools the children were divided into two groups; a difference was noted in favour of the boarders.

As a result of his studies (criteria and figures are not given) Selby recommended a mid-day meal for schoolchildren, free medical attention for all schoolchildren, annual medical examination of schoolchildren and regular weighing. Though I agree with the general trend of his observations, detailed comparisons with my own observations are not possible, as the necessary statistics are lacking from Selby's report; I must, however, comment on one observation of his, namely that boarders were in better condition than day scholars. There are boarders in several of our Methodist schools; without being aware of Selby's observations, I thought that boarders, because of regular feeding and presumably a sufficiency of nutriment, might be in a class by themselves. Therefore I paid particular attention to their heights and weights and sickness statistics. It soon became obvious that there was no difference at all between the boarders and the day scholars with regard to height and weight and general health. The statistics of the boarders were therefore pooled with those of the other pupils.

In the same year, 1945, Dr. B. T. Squires visited Swaziland and reported on the nutritional status of Swazi children[5]. His report was published in November 1945. Squires examined 697 children, 275 boys and 422 girls; 27 or 3.8% had chronic diseases, and were therefore excluded from the final report, as the chronic disease might have contributed to the malnutrition. Of 670 children, 224 or 33.4% showed signs of malnutrition; of the 224 malnourished children, 36 (or 5.3% of the total) showed signs of severe malnutrition. The incidence of malnutrition in boys was 34.6%, and in girls 30.9%; both sexes are considered together, as there was no significant statistical difference between them. Of the schoolchildren, 54% were malnourished, and of the non schoolgoing children 54.8%. At three of the schools there were boarding establishments; the boarders were found to be 25.2% malnourished, while the incidence of malnutrition in the day scholars was 34.5%. At the $P = 0.05$ level, these differences were not statistically significant. Regional variations were also found; malnourished pupils in the Highveld were 27.9%, while in the Middleveld they were 36%. This difference is not significant at the $P = 0.05$ level.

Squires again does not differentiate between undernutrition and malnutrition. He examined eyes, mouth, tongue, skin, and general appearance, and did haemoglobin estimations where indicated. He does not state his criteria for the diagnosis of malnutrition. One presumes his malnutrition figures include also the undernourished; if that be so then his figures show a higher incidence of unsatisfactory nutrition than mine. We are not comparing like with like; it is not therefore possible to make pertinent comments on his figures and mine, but one could wish and hope that the nutrition of Swazi children has improved between 1945 and 1961-63.

Dr. P. Keen in 1938 did an investigation into the diet of the pupils at the Swazi National School[6]. He examined 134 pupils, of whom he gives 7 as being underweight. His criteria for normal weight are not given, nor are the ages and sex of the pupils. His observations showed that

1) Day boys gained weight during the holidays, while boarders lost weight during the holidays;

2) Day girls showed satisfactory weight gains throughout the year, while girl boarders gained well during the first six months of the year, but hardly at all in the second six months.

Keen also noticed that many of the day girls brought food to school with them. He concluded that the diet of the boarders was satisfactory, but that of the day boys was unsatisfactory. He recommended that boarders only be allowed at the school or, failing this, that a meal be provided for day boys at the school. Squires in his survey found no difference between boarders and day scholars; neither did I in my work.

Another assessment of the nutritional state of Swazi children was made by Dr. G. Greenman at Hlatikulu Hospital from October to December 1945. In 294 children she found 45 or 15.3% with frank manifestations of vitamin deficiency. In the same group she found 26 cases of rickets, ie. 9%. Her criteria for diagnosis are not given[7]. Greenman's incidence of malnutrition is much higher than mine, but again one does not know whether she included undernutrition in her figures. Incidentally, in my series I saw no cases of active rickets; healed rickets was seen once only.

Besides Miss Jones' Nutrition Survey and my own figures, the Annual Medical Reports of the Swaziland Government give some figures for malnutrition. The two main categories in these reports are deficiency diseases and malnutrition unqualified; no figures are given for undernutrition as distinct from malnutrition, neither are cases classified according to age and sex. These cases are reported by government and mission doctors, and their criteria for the diagnosis of malnutrition are therefore most unlikely to be uniform.

The figures for 1961, 62 and 63 are as follows:[8]

	1961		1962		1963	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Kwashiorkor	487	24	685	35	463	32
Pellagra	938	6	912	4	603	4
Scurvy	13	0	14	0	43	5
Malnutrition unqualified	1426	41	1629	62	1290	34
TOTAL	2864	71	3240	101	2399	75

In the whole Territory, malnutrition in 1963 accounted for 2399 cases out of a total of 93,740 hospital attendances, giving an incidence of 2.5%. Disregarding Kwashiorkor which occurs in an age group I did not study, the incidence of malnutrition is 2%. This corresponds roughly with my figures, if malnutrition in these reports means what I mean by it.

My figures, as well as those of the other observers quoted above, show that inadequate nutrition is a very serious problem in Swazi children. It will need continuous and careful investigation. Apart from anaemia, which is in most cases mild, there are no severe or chronic debilitating diseases which could account for the high incidence of undernutrition in these children. Even the clinically diagnosed tuberculotics were in good physical condition. The undernutrition must therefore be regarded as a primary deficiency, caused by lack of sufficient food.

Remedies for the correction of this unsatisfactory state of affairs are many and varied, but the obvious ones that come to mind are

1) increased food production; if this proves insufficient for the people's needs, then wholesome foods will have to be imported.

2) the people will have to be instructed in the preparation of food and will have to be taught basic nutrition.

3) "Examples in food" will have to be provided for all sections of the population on a national scale. Such examples would be in the form of school meals and meals at places of employment. The women will have to be visited in their homes and demonstrations in food handling and preparation will have to be arranged for them.

These measures are steps which the government authorities should take. A problem has been defined, to which there is an obvious solution. Human resources are being wasted if one allows one quarter of one's young and growing population to be undernourished. I must again point out that the schoolchildren studied by me were on the whole the more privileged section of Swazi youth, and the criteria by which their nutritional status was assessed were derived from the pupils themselves. They were undernourished not by British or American standards, but by standards derived from their own population.

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3) Jones, S. Page 208.
4) Selby, S., (unpublished). Report to the Swaziland Government on the Nutrition of Swazi Children. Typewritten. 1945.
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6) Keen, P., "An Investigation into the Diet of the Pupils at the Swazi National School during 1938. "Swaziland Annual Medical Report, 1938. Appendix, page 27.
7) Greenman, G., Quoted by B.T. Squires in 5) above.
8) Swaziland Annual Medical and Sanitary Report, 1963. Page 10.

3) ERRORS OF REFRACTION.

a) Pupils tested. In the first year of the school health service, all pupils from standard one up had their vision tested, using a Snellen's chart. It soon became obvious that most of the children in standard one could not read at all. Therefore in 1962 only pupils from standard two up were tested routinely, together with those pupils in standard one who definitely could read. Even in standard two and higher there were pupils who could not read or who did not have the courage to read English letters. In the first year 1162 pupils of both sexes were tested; in 1962 they numbered 2157, and in 1963 there were 2222. Some of the pupils had eye tests every year for three years, some had eye tests for two years in succession, and some had one eye test only. The figures given below refer to first tests only.

Out of the 5541 pupils who had eye tests over three years, defective vision in one or both eyes was found in 634, ie. 11.4%. Pupils in whom both eyes were affected number 271, ie. 4.9% of the total population. Of the 634 pupils with defective vision, 298 or 47% were boys, and 336 or 53% were girls.

Further analysis of the 634 cases of defective vision shows that errors of refraction were present in 601 pupils, ie. 94.8%, and eye diseases were found in 33 pupils, ie. 5.2%.

Errors of Refraction 601; boys 288, girls 313;

Eye Diseases 33; boys 10, girls 23.

b) Method used.

i. At the Schools: The ordinary Snellens chart for distant vision was employed; charts were read in broad daylight but not in direct sunlight. Each eye was tested separately, the child covering the other eye with the palm of the hand. Where the child could read 6/6 or better with each eye, vision was recorded as normal; where visual acuity was worse than this in one eye or both, error of refraction was diagnosed. Natural errors in reading were allowed for, for example where a child mistook a C for an O, or a Y for a V. Astigmatism was diagnosed on the reading of certain "catch" letters, such as mistaking an E for a B, a P for an R, an H for an N, etc. In the lower classes pupils were encountered who could not read (? pronounce) English letters, but who could read short Zulu words. Such cases were deferred for a year; they were recorded as vision tested, but not as error of refraction. In standard one, as stated before, the majority of pupils could not read at all. Their vision was tested again a year later, by which time most of them had learned to read.

In 1961 an attempt was made to use "illiterate Es" for pupils who could not read. This was a complete failure, as neither the children nor the teachers could understand the method. After this animal test charts were tried, such as are normally used for European pre-school children. This, too, proved a failure, as the children were in almost all cases quite unable to identify the figures on the chart, probably because they had never seen such objects before, and the necessary mind-eye connection was thus lacking. In 1962 and 63, therefore, only the Snellen's chart was used at the schools. In the Report of the British Faculty of Ophthalmologists for 1957/58 it is recommended that distance vision worse than 6/9 in either eye (Snellen) should be investigated fully. They also recommend that school entrants should have their vision tested as soon as possible after starting school. [1]

ii) At the hospital. Here I was equipped with the necessary aids for complete eye testing. Every child reporting for an eye test had a clinical examination of the eyes, ophthalmoscopy (with cycloplegic if necessary), a repeat test with Snellen's chart, and a reading test with Jaeger types for near vision. Being able to read Jaeger type 3, D = 1.00, or better, was regarded as normal.

A note on Colour Blindness. The Bantu perception of colours differs from that of Whites; attempts to use the Ishihara colour charts on these pupils proved unsuccessful. Teachers were therefore asked to find out whether pupils could tell red chalk from green. I was informed that all could do this, but do not know whether these tests were done properly, or whether the results were based on "knowing" rather than "seeing". Of 73 pupils whose colour vision was tested at the hospital by myself, none were colour blind. Tests were done by reading and matching greens, greys and reds of various shades and intensities.

According to the British Faculty of Ophthalmologists, eight percent of boys and 0.4 percent of girls in Britain are colour blind.[2]

c) Results.

i. At the schools.

	BOYS			GIRLS			ALL		
	One eye	Both	Total	One eye	Both	Total	One eye	Both	Total
Refraction Error (RE)	116	82	198	157	103	260	273	185	458
Astigmatism (Ast)	33	34	67	12	13	25	45	47	92
Combined (RE and Ast)	14	9	23	17	11	28	31	20	51
Eye Diseases									
Blind	1	x	1	x	x	x	1	x	1
Amblyopia	4	x	4	4	x	4	8	x	8
Scar Cornea	2	x	2	3	x	3	5	x	5
Trachoma	x	1	1	x	2	2	x	3	3
Conjuncti-vitis	x	2	2	x	11	11	x	13	13
Squint	x	x	x	x	2	2	x	2	2
Alexia	x	x	x	x	1	1	x	1	1
TOTALS	170	128	298	193	143	336	363	271	634

All errors of refraction combined, excluding eye diseases, can be expressed as the following percentages:

	BOYS	GIRLS	BOTH
Refraction errors (excluding astigmatism)	63.7	83.0	75.8
Astigmatism only	23.2	8.0	15.6
Combined(RE plus Ast)	8.1	9.0	8.6

ii. At the hospital.

Of the 601 pupils with errors of refraction, only 73 came to the hospital for complete eye testing; there were 40 boys and 33 girls. In three children, two girls and one boy, the visual defect was due to spasm of the accommodation without refraction error, and was relieved by cycloplegics. In the remaining 70 there were abnormalities of the media of refraction. The incidence of the different categories was much the same in the two sexes and so, the numbers being small, they have been pooled for final analysis. The figures are:

Myopia	plain	49	60	85.7%
	with astigmatism	11		
Hypermetropia	plain	0	2	2.9%
	with astigmatism	2		
Astigmatism only		8	8	11.4%

Normal: Snellen 6/6 each eye; Jaeger type 3 (D = 1.00) each eye.

In passing it is worth noting that children whose vision had been found normal at the schools came in large numbers to have their eyes tested at the hospital, as this service was free. In no case was an error of vision detected at the hospital where the pupil's refraction had been normal at the school.

d) Comments on Results: The incidence of defective vision was found by Bishop Harman, F.R.C.S., to be 26% in 22 thousand pupils in London in the 1930s [3]; in Scotland the incidence is about 23% in schoolchildren in the City of Edinburgh. [4] British figures for 1956/57 reveal that visual defect is present in 13% of British schoolchildren of all ages, and that about 3% of school entrants have defective vision. [5] Compared with the recent British figures, the incidence of defective vision in Swazi schoolchildren, ie. 11.4%, is about average. The real difference, however, is in the percentages of the different forms of visual error. Bishop Harman, who did refractions on 1000 schoolchildren in London, using cycloplegics, found the following percentages: [6]

Hypermetropia	42.55%	71.19%
Hypermetropia/Astigmatism	28.64%	
Myopia	9.27%	19.72%
Myopia/Astigmatism	10.45%	

The ages of his pupils are not stated in the review at my disposal, but they can be assumed to have been primary schoolchildren aged 6-16 years. Harman found myopia or astigmatism rare in younger children, but increasing steadily with each year of age. This agrees roughly with my series, as the average age of the 73 pupils whom I tested was 15 years; none of them were under twelve. In spite of this, the incidence of myopia in our children is disproportionately high.

More recent British figures confirm this disproportion. A comparison of my Swaziland figures for 1961, 62 and 63 (70 refractions) with 1958 figures from Birmingham (750 refractions) and Middlesex 1960 figures (240 refractions) is given in the following table.[7, 8]

	Birmingham 1958	Middlesex 1960	Swaziland 1961/62/63
Myopia Plain With Astigmatism	28.2%	55%	85.7%
Hypermetropia Plain With Astigmatism	44.75%	34.5%	2.9%
Astigmatism only	3.6%	x	11.4%

Myopia is hereditary in almost all cases. It may be due to a congenitally long eyeball (inherited as a recessive) or excessive corneal curvature (inherited as a dominant). The long eyeball is the commoner condition; excessive corneal curvature is less common but is more often associated with astigmatism. No explanation can be given for the high incidence of myopia in our children; Bishop Harman worked with much larger numbers and his technique, being an expert ophthalmologist, is probably much superior to that of a general practitioner in a mission hospital. His series and mine are not really comparable; I offer my figures as a basis for comparison to other observers who may be doing refractions among Bantu children in the future. However, even without going into detail, a problem exists in that over ten percent of Bantu children in Swaziland are in need of aids to vision. This problem is probably more acute and serious than it would be in White children, as these African children are expected to read and write in schools and homes where illumination is for the most part very poor. Under such circumstances even a small error of refraction becomes a big obstacle to study.

To the best of my knowledge, figures comparable to mine are not available for Bantu children in other parts of Southern Africa.

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4) DISEASES OF THE EAR, NOSE and THROAT.

a) Method and criteria. The noses and throats of all pupils were inspected as a routine, using a pencil torch for optimum illumination. Ears were examined only if the teacher reported ear or hearing trouble, past or present, or if the pupil complained of these. This method was chosen to save time and yet to examine ears in case of need.

The criteria adopted for diagnosis were:

Suppurative Otitis Media:	perforated ear drum, with or without purulent discharge, in one or both ears.
Tonsillitis:	Acute inflammatory enlargements of the tonsils; exudates of follicular tonsillitis; chronic enlargement with adhesions or loss of mobility.
Cervial Lymphadenitis:	Only bilateral enlargement of the lymph glands in the upper anterior triangle of the neck was accepted as indicative of ENT disease.
Purulent Rhinitis:	Purulent discharge from one or both nostrils. Clear discharge was not accepted, neither was encrustation without discharge.

b) Results. The tables give the overall figures for the whole school population, and also further details of the pupils showing diseases of the ear, nose and throat.

OVERALL PICTURE.

Year	Pupils examined	Ear/Nose/Throat Disease/s					
		Boys		Girls		Both	
		No	%	No	%	No	%
1961	2012	96	9.6	112	11.0	208	10.3
1962	2733	66	4.7	84	6.3	150	5.5
1963	3103	59	3.7	87	5.5	146	4.6
Totals	7848	221	18.0	283	22.8	504	20.4
Average per annum (percent)			6.0		7.6		6.8

Pooling the diagnoses of the three years for a more detailed analysis of ear/nose/throat diseases, we break down the 504 episodes as follows:

	Boys		Girls		Both	
	No	%	No	%	No	%
1) Suppurative Otitis Media	1	0.4	3	1.0	4	0.8
2) Tonsillitis						
a) plain	67	30.3	151	53.3	218	43.2
b) with cervical lymphadenitis	22	10.0	28	9.9	50	9.9
3) Cervical lymphadenitis						
a) plain	67	30.3	48	16.9	115	22.8
b) with tonsillitis	19	8.6	21	7.4	40	8.0
c) with pur. rhinitis	2	0.9	1	0.3	3	0.6
4) Purulent Rhinitis						
a) plain	37	16.7	27	9.5	64	12.7
b) with lymphadenitis	2	0.9	4	1.4	6	1.2
c) with tonsillitis	1	0.4	0	0.0	1	0.2
5) Deafness	3	1.3	0	0.0	3	0.6
TOTALS	221	99.8	283	99.7	504	100.0

Considering both sexes together, we get the following composite picture:

	Number	Percentage
Suppurative otitis media	4	0.8
Tonsillitis (with or without lymphadenitis	268	53.1
Cervical lymphadenitis (with or without tonsillitis and/or rhinitis)	158	31.3
Purulent rhinitis (with or without tonsillitis and/or lymphadenitis)	71	14.0

Comments on results: The average annual incidence of 6.8% shows that diseases of the ear, nose and throat are not a serious health problem in these children. The high incidence in 1961 must be ascribed to seasonal factors; as all the children were examined in the spring, when upper respiratory infections are prevalent. Suppurative otitis media accounts for 0.8% of disease only, while deafness represents a mere 0.6%. The severity and chronicity of infections of the nose and throat are usually gauged by their effects on the ears; as these are negligible in this series, one concludes that most of the infections are seasonal and mild, and that even the more serious and chronic ones are of minor severity.

Diseases of the tonsils, with or without lymphadenitis, account for well over half of the total while lymphadenitis, always secondary to another upper respiratory infection, accounts for nearly a third of cases. A surprising finding is that purulent rhinitis, together with other infections, accounts for one case in seven; it is seldom associated with other infections of the upper respiratory system. The reasons for this are obscure, but there may be some connection between purulent rhinitis and the high incidence of disease of the accessory nasal sinuses in the Bantu, an avenue which was not explored in the present series.

In the literature I could find no other comparable series for discussion.

5) HEART DISEASE.

Of all the children examined, none complained to their teachers or to me of any symptoms suggesting heart disease. Heart disease was thus diagnosed purely on physical signs. These were: Persistent tachycardia, after exercise or at rest; irregularity of the pulse not disappearing on exercise; clinically obvious cardiomegaly; presence of murmurs not regarded as functional.

A total of 22 pupils were found to have heart disease on first examination during the three years of the school health service. Total

examinations done were 7,848, which gives a total incidence of heart disease of nearly 0.3%. Of the 22 pipils, 16 were boys and 6 girls. Detailed analysis is neither possible nor feasible, as diagnoses are clinical only. Cases can be roughly grouped as follows:

	Boys	Girls
a) Enlarged heart, with fast or irregular pulse	8	2
b) Rheumatic valvular lesion	5	4
c) Congenital heart disease	3	0

None of these pupils had previously had medical advice; neither children nor teachers knew that heart disease was present. Only one of the pupils reported for further examination; he was a boy aged 16 in whom cardiomegaly was confirmed radiologically, but no cause could be found for it. Clinical rheumatic heart disease attacks 3 per thousand of all South African schoolchildren; the prevalence in Bantu children separately is not known.[1]

REFERENCE:

Cluver, E.H., Public Health in South Africa. C.N.A. Page 215.

6) ORTHOPAEDIC CONDITIONS.

This category includes all congenital and acquired diseases of the musculoskeletal system; 23 children of both sexes seen during the three year period appear under this heading. 23 first diagnoses of musculoskeletal diseases were made in 7,848 examinations, ie. nearly 0.3%. Of the 23 pupils, 15 were males and 8 females. Tabulation shows the following deformities:

Condition	Boys	Girls	Total
Club foot	3 (unilateral)	2 (unilateral	5
Spinal deformity	2 (1 tuberculous 1 postural)	3 (2 tuberculous 1 postural	5
Limb deformity	4 (3 leg, 1 arm)	2 (leg)	6
Hemiplegia	4 (1 traumatic 3 spastic	0	4
Neck deformity	0	1 (chronic torticollis)	1
Chest deformity	2 (1 traumatic 1 rachitic)	0	2
	15	8	23

From my general clinical work in Swaziland I am under the impression that the incidence of crippledom in the Territory is much higher than the percentage given for schoolchildren. Apparently only reasonably fit pupils are sent to school. The boy with the rachitic chest deformity was the only pupil who bore evidence of healed rickets. Active rickets, as stated above, was not encountered at all.

7) MENTALLY SUBNORMAL.

One does not expect to see gross mental abnormality in schoolchildren; idiocy and imbecility and other severe mental impairment are usually obvious to laymen, and such children are kept at home. In spite of this, seven (7) mentally subnormal children were seen over three years; all were boys.

In two cases the mental subnormality was associated with infantile hemiplegia, these boys being graded as feebleminded.

In one case the boy was an idiot, in whom no physical disease was found. He had been going to school for six years, merely by following other children there.

The other four boys were also classed as feebleminded; this diagnosis was based on scholastic performance and behaviour patterns. No physical disease was found in any of them. In none of the seven were there any affected siblings.

Epilepsy was encountered twice, but both pupils, one boy and one girl, were mentally normal.

8) SKIN DISEASE.

Diseases of the skin are a relatively small group. 131 cases, made up of 85 boys and 46 girls, were diagnosed in 7,848 examinations, giving an incidence of 1.6%. Analysis shows the following groups:

		Boys		Girls		All	
		Number	%	Number	%	Number	%
Fungus infections (Ringworm)							
(all parts of body)	Plain	50	55.5	32	78.0	82	62.6
	Infected	0	-	0	-	0	-
Pyodermia		8	9.4	2	4.4	10	7.6
Scabies	Plain	0	-	2	4.9	2	1.5
	Infected	11	12.9	5	10.8	16	12.2
Others							
Neurofibromatosis		3)		1)		4)	
Vitiligo		2)		0)		2)	
Phrynoderma/Hyperkeratosis		8)	17.7	2)	12.2	10)	16.0
Acne Vulgaris		3)		1)		4)	
Lupus Vulgaris		0)		1)		1)	

Notes: Under the heading fungus infections are included two cases of pityriasis versicolor, both boys.

Not a single case of warts was seen, even though I was on the look out for these. Detailed examination for pediculosis was not possible in the time available to me, but enlarged posterior cervical lymphglands, so characteristic of scalp infection, were found once only, in a girl. Pediculosis would therefore appear to be rare in these children. By contrast, in 1956/57, 3-4% of British schoolchildren were found to be verminous; this was about half the number found verminous in 1948.[1]

REFERENCE:

1) Report of Chief Medical Officer, Ministry of Education, 1956/57, HMSO, 1958.

Comments. The preponderance of skin diseases in boys links up well with their known poor hygienic habits; girls are much cleaner than boys. The commonest single skin disease in both boys and girls is ringworm, accounting for 62.6% of skin disease in both sexes. Of the 82 cases encountered, 70 were tinea capitis and only 12 tinea corporis. All children with tinea capitis were under 14 years old, though tinea corporis occurred at all ages. This is in keeping with general dermatological experience. Not a single case of infected ringworm (kerion) was seen.

Scabies, which one would expect to be common, was in fact uncommon, accounting for only 13.7% of skin disease in both sexes combined. All but two cases of scabies were secondarily infected. The

standard of cleanliness in these pupils must, in view of the low incidence of scabies, be regarded as good.

Pyodermia is also uncommon; the incidence is about half that of scabies. This again would indicate a good standard of personal hygiene.

An overall incidence of 1.6% makes skin diseases a problem of only minor importance in these pupils. However, it is likely that pupils affected by skin diseases, which are readily visible to teachers and other pupils, would stay at home on the days on which medical examinations were being conducted. Thus the low incidence in the present series might well be more apparent than real.

9) UMBILICAL HERNIA.

This condition was encountered so frequently that a special analysis was made of it. No distinction was made between large and small hernias, neither were the hernias differentiated on the contents of the sac, ie. whether it was peritoneum only or bowel as well. Surgical textbooks state that the umbilical hernia of adults is really a paraumbilical hernia, and not a weakening of the cicatrix. The true umbilical hernia, due to weakening of the cicatrix, is said to be found in infancy only.[1] These statements are not borne out by the present series; both types of hernia were seen with about equal frequency. One might argue that the true umbilical hernias had been present since infancy; this is invalidated by the fact that 17 of the "new" hernias, ie. 30%, were umbilical and not paraumbilical in nature.

In 7,848 examinations, umbilical hernia was diagnosed 179 times, an incidence in all pupils of 2.3%. I have not been able to find figures for the incidence of umbilical hernia in other populations in the 6-18 year age groups, but all textbooks are agreed that the condition is commoner in females, the ratio being 5 females to one male.[2] In the present series there were 67 males and 112 females, giving a sex ratio of approximately 3:5.

In the classification "new" hernias are dintinguished from "old". Where a hernia was present at the first examination it was classified as old; where the pupil had no hernia at the first examination but had developed one by the second examination it was classified as new. The table shows the findings over three years.

Age (years)	Boys Old	Boys New	Girls Old	Girls New	All Old	All New
6	0	0	3	0	3	0
7	2	1	12	4	14	5
8	8	0	11	9	19	9
9	7	0	13	3	20	3
10	3	4	8	2	11	6
11	6	5	8	2	14	7
12	8	3	19	4	27	7
13	7	3	3	4	10	7
14	1	1	2	3	3	4
15	0	1	0	1	0	2
16	2	1	0	0	2	1
17	4	0	1	0	5	0
18	0	0	0	0	0	0
	48	19	80	32	128	51
	67		112		179	

Table of the Percent Incidence of Umbilical Hernia.

	Old	New
Boys	71.7	28.3
Girls	71.5	28.5
All	71.5	28.5

The greatest number of umbilical hernias, old and new, would appear to develop before puberty, that is, up to the age of 14. There is no apparent reason for this phenomenon, but from the point of view of treatment one would advise children to have their hernias repaired at the age of 15 or 16 years, ie. before they would normally leave school.

REFERENCES:

1) and 2) Bailey and Love, "A Short Practice of Surgery", 11th Edition, 1959. H. K. Lewis, London. Pages 701, 702.

10) GOITRE.

According to a survey by the Department of Nutrition, Swaziland is regarded as a goitre area, the cause being lack of iodine.[1] As I was aware of their findings, I was on the lookout for goitre and other thyroid

pathology. Jones states in her survey[2] that 25% of girls aged between 10 and 16 years had enlarged thyroids, though she does not mention whether these were regarded as physiological or as goitres. She puts the enlargement down to the stresses of puberty; in boys she did not see any enlarged thyroids.

In my series the findings were very similar to hers; I did not keep statistics of all enlarged thyroids I saw, but registered only the frank goitres. While thyroid enlargements were not encountered in boys, they were commonplace in girls. Over three years, only three cases of goitre were seen, all in girls, and all colloid goitres showing a diffuse enlargement of the gland. Pupils were aged 12, 13 and 14 years. None reported for treatment.

REFERENCES:

1) Endemic Goitre in the Union of South Africa and some Neighbouring Territories. Department of Nutrition, 1955.
2) Jones, S. "A Study of Swazi Nutrition", University of Natal, 1963. Pages 211, 233.

11) SCHOOL LEAVERS.

It was extremely difficult to determine why pupils left school; in only isolated instances could teachers or pupils give any explanation. Some pupils had of course passed the highest standard in their school and had left after that, but even here one could only rarely find out whether they had gone on to another school for further education or whether they had left school altogether. While it was difficult to get information about pupils who left at the end of the school year, it was even more difficult to find out why they left school or were absent for long periods during the year. The African in general believes that it is the teacher's task to get him through his examinations; the pupil himself has to do nothing except to attend school. Therefore, if the child fails at the end of the year teachers and the school are regarded as useless, and the parents will send the child to another school, often in a completely different area. Sometimes, too, children are taken out of school and kept at home, often for long periods, for purely domestic reasons such as herding the cattle or helping to build a new house. Attempts to find out the reasons for absences and school leaving landed me in a jungle of invalid, false and contradictory explanations. I therefore gave up this task in 1962, the second year of the Service, and discarded all information I had obtained about school leavers. Cards were marked merely "absent" or "left"; no reasons were entered.

The Bantu are still essentially a nomadic people, and, whereas in the past entire populations moved from place to place, so now individuals move from place to place, in this case from school to school.

Of the 7,848 pupils of both sexes examined during the three years of the Service, no fewer than 1,340 left school, ie. 17.0%. Of 3,906 girls examined, 642 or 16.4% left, and of 3,942 boys examined, 698 or 17.7% left school. As I could not determine the reasons for their leaving, I do not know to what extent ill health played a part in the parents' decision. Of the 698 boys who left, 318 of 45.5% were ill, and of the 642 girls who left, 330 or 51.4% were ill. Of the total of 1,340 pupils who left, 648 or 48.3% were ill.

Comparing the percentage of illness in school attenders and school leavers we find:

	School Attenders	School leavers	Statistical analysis shows
Boys	41.7	45.5	no significant difference
Girls	49.0	51.4	between these sets of
Both	45.4	48.3	figures.

Though we cannot tell what part ill health played in the decision to leave school we see, however, that there was as much illness among school leavers as among school attenders. If a child cannot make the grade in school he is unlikely, in the absence of good health, to make a success of his studies at another school, or to succeed at work. Furthermore, he is unlikely to get his ill health attended to after he leaves school, as most of the illnesses afflicting schoolchildren are not incapacitating to any severe degree, and employers tend to be less sympathetic in such cases than teachers.

(F) PROPHYLACTIC INOCULATIONS.

i. Smallpox vaccination. All government hospitals and clinics, as well as teams from the Health Department, did free vaccinations against smallpox. Thus we did not do any during the first year of the Service. During 1962 variola minor broke out in Swaziland, and eventually assumed epidemic proportions. Government intensified their vaccination campaign, and teams of Health Assistants toured the country to vaccinate all susceptible individuals. In spite of this, at my school health examinations I was amazed to note that fully a third of the pupils bore no evidence of successful vaccination, even after two years of propaganda. I therefore decided to include smallpox vaccination as part of the Service in 1962 and 63. Any pupil who did not have a successful vaccination scar, or who had not been vaccinated during the preceding three years, was vaccinated.

Vaccinations numbered 1,007 in 1962, of which 334 were first vaccinations and 673 revaccinations. No complications were reported to me; percentage of "takes" is not known for that year, as only one visit was paid to each school.

In 1963 two visits were paid to each school, but the number of vaccinations was much lower, as government teams had by then become well established and better organised. Primary vaccinations in 1963 totalled 361 with 84% successful takes, while revaccinations totalled 64. Again no complications were reported, except a few cases of mild sepsis.

ii. T.A.B. Vaccine. Typhoid and paratyphoid fevers are common in Swaziland. There are regional and seasonal variations in the occurrence of cases, but the greatest prevalence is in summer. In 1963, the enteric fevers accounted for 378 cases out of 16,693 hospital admissions, an incidence of 2.2%. These were notifications from hospitals only, and the true number of cases must be very much larger than the number notified.[1] It was thought well worthwhile to inocculate pupils against this group of diseases. Due to unavoidable delay and factors beyond our control, sufficient vaccine was not obtained before 1963. The vaccine used was the typhoid-paratyphoid vaccine of the South African Institute for Medical Research, and contained Salmonella Typhi, as well as Salmonellae paratyphi A, B and C. In some ways it was a blessing that we did not start these injections earlier, as they were extremely unpopular due to the local pain and the associated constitutional disturbances. Many parents in fact informed the teachers that they would not allow their children to have these injections again, as these injections made the children "sick instead of healthy". In spite of this, we did manage to give two injections of the vaccine to most pupils during 1963.

First injections totalled 3,103; repeat injections totalled 2,793, ie. just over 90%. Injections were spaced a week apart, and teachers were warned about the untoward effects; they were empowered to let the children go home after the injections. This concession proved popular, and a day off no doubt made many pupils and parents decide in favour of the injections. At this stage it is of course quite impossible to assess the efficacy of these injections, but they should help substantially to cut down the incidence of the typhoid group of fevers in the next two or three years, at least among schoolchildren.

iii. B.C.G. Vaccine. Mantoux tests were done for the first time in 1963, and our intention was to give B.C.G. Vaccine to all negative reactors the following year if we could find someone to pay for the vaccine. However, our medical work was terminated at the end of 1963, and it was thus not possible to do anything more about this very necessary measure.

REFERENCE:

Swaziland Annual Medical & Sanitary Report, 1963, page 7.

IV. DISCUSSION

a) Limitations of the School Health Service

Until the Mahamba Methodist Hospital started to provide a regular annual school health service, there had been no organised or regular efforts made in Swaziland to treat schoolchildren as a specific section of the population, and to provide preventive and promotive health services for them. In looking back on this effort, which extended over three years and which would still be continuing if our medical work had not been terminated, I am clearly aware of the limitations of this service. The European Conference of School Health Services, sponsored by WHO and held in Grenoble in 1954, recommended one full-time doctor for 4,200 schoolchildren, and a case load of four pupils per hour. "Specialist" services were not to be a part of the school doctors' duties; all illness other than minor illness was to be referred to other doctors for investigation and treatment. The Conference also recommended one full-time school nurse for up to 15 thousand pupils, the number of pupils per nurse varying according to local circumstances. When we remember that distances are for the most part short, and populations concentrated in Europe, one can take a realistic view of the difficulties which faced us in Swaziland.

A single observer in busy hospital practice, with a number of scattered outside clinics also to serve, working under adverse financial conditions and covering 15 schools in a Territory served by indifferent roads, cannot expect to produce results obtainable under more favourable conditions. As this was a completely unexplored field, I naturally tried to get as much information as possible to provide a "base line" of normal standards for these children. One was working with a section of the population for whom even average heights and weights were not known; their general state of health and the incidence of the more common diseases among them were also unknown. Schools were often reached after a long drive following a disturbed night at the hospital; one then started the day's work already fatigued. Considering all these factors together, one had to limit one's efforts rigidly and to do only what was possible, and not what one would have liked to have done. The limitations of this service were therefore conditioned by :-

i. The limited capacity and ability of a single observer:
ii. Financial stringency:
iii. Transport difficulties;
iv. The lack of previous efforts in this direction, forcing one to start from scratch:
v. The attitude of pupils and parents to this "new thing".

The Swazi are rigid traditionalists; right up to the end we had to bring pressure to bear on them to allow us to examine their children. They could not understand why "healthy" children should have an annual medical

examination. No doubt these children, representing the best of Swazi youth, were healthy compared to those who were kept at home; yet the incidence of disease in this population was staggering.

In these days of specialisation and teamwork the single handed medical observer if often frowned upon; while it is true that the single handed observer tends to repeat the same mistakes year after year, I was alone in this work not by choice but through necessity. We felt it had to be done, and there was no one else to do it, or to help us in doing it. The great need for this type of Service is my justification for organising and running it, in spite of all the limitations of such an effort. Some of the things one would have like to have done, had time and staff and money, been available are the following :-

A comparison of the school performances of healthy and unhealthy pupils;
A detailed investigation of the perplexing problem of dyshaemopoietic and iron deficiency anamia in a country well supplied with dietary iron;
Routine urine and stool microscopies of all pupils;
A complete dental survey, assessing particularly the incidence of caries;
Investigation of water supplies, and inspection of lavatories, hostels and other day and sleeping accommodation, as well as of classrooms;
Health Education of teachers, pupils and parents.

b) Progress from year to year

With increasing experience of this kind of work, one became more adept at overcoming and even forestalling difficulties. The poor reading ability of standard one pupils made one leave them out of routine sight testing in 1962; the early recognition that illiterate Es and animal test charts could not be used on these pupils saved much time, and effort, in the second year of the Service. The large number of clinically anaemic pupils made one do Hb estimations on all suspected anaemias in 1962. Incidentally, this led to the resurrection of the Talquist method, which I regarded as practically useless for many years previously, but which now proved to be accurate enough for screening purposes.

As teachers invariably did not inform parents of my findings, we introduced printed slips in the second year of the Service. These slips, signed by me, gave the child's name and number, the disease found, and the name of the school. The slips were sent to the head teachers of the schools and were handed to the pupils. When reporting to the hospital for treatment, children had to produce these slips in order to be treated for 10c instead of the 50c fee collected from other patients.

In the second year of the Service, smallpox vaccination was offered to all pupils, as it was found that Government teams were unable to vaccinate all the people in need of it. In the third and last year of the Service, all the above were again carried out, but in addition every anaemic pupil who reported for treatment had a blood smear examined and a urine microscopy if the othotolidine test revealed haematuria. Mantoux testing was added also in 1963, and in addition all pupils had one injection of TAB vaccine, with over 90% getting the second injection also.

Cessation of our medical work in Swaziland was rather sudden. We had already made our plans for 1964, which envisaged further expansion. BCG vaccination was to be offered to all tuberculin negative pupils; oral poliomyelitis vaccine was also to be given to all. A special school health nurse was to be appointed. She would visit all the schools and follow up our findings; she would offer treatment for the minor illnesses; she would collect blood and urine and stool speciments for laboratory examination. Government interest in this Service was great, and we would have obtained help from the authorities in providing these services.

c) The Size of the problem in the light of our findings

Neither I nor the Government authorities, to whom a precis of our findings was given every year, had expected to find so much ill health, most of it remediable, in Swazi schoolchildren. When nearly half the children in our schools are unhealthy, there is an urgent need for a country wide school health service. The bad examination results and high percentage of school leavers must at least in part be due to the indifferent health of the children. Educational effort is wasted when the pupils at whom it is directed cannot absorb it because of ill health. Quite apart from this, the poor state of health of these children reflects an unsatisfactory economy, improvement of which would benefit the entire nation. Where 25% of the school-going population is undernourished, measures for better feeding at the schools and at home become urgently necessary. This problem touches the very fundamentals of the Swazi economy. It must be remembered that schoolchildren in Swaziland are a privileged section of the population, a select sample; one can only guess at the state of health of those children who do not go to school. Next to the large amount of illhealth found, the most outstanding impression gained from this work was the almost complete lack of interest in it shown by the majority of pupils, teaches and parents. Together with a school health service one should therefore provide, through health education, a receptive community.

d) Future developments

While habits and customs of doubtful value seem to take root almost instantly in Africa, good habits such as the "health habit" seem to become established with the utmost difficulty. Future developments must therefore be based on the soundest possible foundation, i.e., health education. This must be disseminated on the widest possible scale; not only schoolchildren,

but also teachers and parents must be made health conscious by extensive and intensive propaganda. On this foundation a sound system of preventive health must be built, of which a school health service is only one aspect.

Sound preventive health measures in the preschool years should produce a body of "fit" pupils for school entry; pupils who are adequately nourished, not anaemic, and protected against the communicable diseases by prophylactic inoculations wherever practicable. In an underdeveloped country such as Swaziland, with limited capital resources, it would be very difficult and costly to provide a comprehensive pre-school preventive health programme. Therefore, the school children, being a captive audience, must be tackled with great intensity during the first year or two of school. I feel that the doctors appointed to this task should be members of the general medical service, so that they would also be familiar with the health problems of other sections of the population, and could see "school health" against the essential backgound of general health.

e) Recommendations

I feel that the work started by us needs to be continued and developed as a matter of urgency; the figures alone show the magnitude and urgency of the problem. If I were asked to make recommendations and were given the power to implement these, I would proceed as follows :-

1) A countrywide school health service would be instituted. It would be run either by full-time doctors who would do other general work also in their spare time, or by doctors doing general duties who would regularly give some of their time to school health work. A reasonable work load would ensure a good standard of work; I would regard our 15 schools with 3000 pupils as warranting their own schools medical officer full-time, if the aim is to provide a really comprehensive service.

2) A number of school nurses would be appointed; these would devote all their time to the health of schoolchildren, and would take much routine work off the doctors' shoulders. Such nurses could, for example, give prophylactic inoculations, do routine eye testing, measuring and weighing, treat minor ailments, and advise on hygiene and sanitation. After school hours, during holidays and on Saturdays, the school nurses would attend at clinics for pre-school children, and would visit schoolchildren in their homes. This would give them a more comprehensive outlook, and would allow them to see their duties in relation to the whole field of public health.

3) Every school would be compelled to have a vegetable garden and to keep a number of cows or goats or both; every school would also have to grow its own supply of cereals. With the acquisition of livestock and vegetables and cereals, each school would provide a midday meal for each of its pupils. Pupils themselves would look after the gardens and the animals; crops and livestock would be checked frequently by agricultural officers and veterinarians. This expert advice would be available free to schools.

4) Regulations for school attenders would be tightened up and strictly enforced. No child would be allowed to start school unless it had been successfully vaccinated against smallpox and had been immunised against poliomyelitis; proof of this would be required. All children would be immunised against typhoid and paratyphoid fevers during their first year at school. Those who refused to have this done would not be promoted to the second year, regardless of their attendance record and examination results. Also during the first year at school, every child would have a Mantoux test, and all negative reactors would be given BCG vaccine.

5) There would be a regular annual medical examinations of all schoolchildren. In some other countries, such as the United Kingdom and United States of America, three school health examinations up to the age of sixteen are regarded as sufficient. One must remember, however, that these are fully developed countries with reasonably health conscious populations, to whom medical services outside their schools are readily available. This does not hold for a country such as Swaziland. Medical attention at school is in many cases the only medical attention available to the child, and thus the effort must be more intensive. In addition, the more frequently the children are examined, the sooner will the children and their parents become health conscious. Even in the three years of our pilot service, we progressed from hostile rejection to grudging acceptance; in the second year two quite unrelated schools voluntarily joined the Service. Two or three more years would have established the Service firmly in the lives of pupils, teachers, and parents, if not in their affections.

6) In this personal effort I have defined the problems and given them in broad outline; merely the surface has been scratched. There are many more problems to be uncovered and to be defined; even those I found,

need much more thorough and complete investigation. Therefore, before a school health service was started, I would advise a thorough preliminary survey of the pre-school and school population, preferably by well equipped teams of specialists. Such a survey could uncover, outline and investigate relevant problems, and provide far more basic data than I was able to do. Without this essential preliminary work, I feel it would not be possible to organise a really satisfactory and efficient school health service.

V. SUMMARY AND CONCLUSIONS

1. A Survey is presented of a school health service for African school-children attending 15 mission schools in South Western Swaziland. This is a Highveld area, well watered, but poor in soil for agricultural purposes. The people, most of whom are peasant farmers, lead a hand to mouth existence; they are a homogeneous population of about 40,000 people, with a population density of 66 persons per square mile. The children attending schools in the area represent the privileged section of Swazi youth, as schooling is not compulsory in Swaziland, and only the more enlightened parents send their children to school.

2. The purpose of the school health service, the first to be provided in Swaziland, was to gather basic data on heights and weights, to assess the incidence of different diseases in the children, to remedy such ill health as was within our power and means to do, and to offer preventive services wherever possible. The service ran for three years, 1961, 62 and 63, and became more comprehensive as it went along; hindering factors were lack of staff and money, long distances to be covered, and the size of the task. Our aims were realised in part; much useful data was obtained, and an overall impression of the health was gained. A total of 7848 pupils of both sexes was examined.

3. a) Heights and Weights, age and sex specific, were obtained for boys aged 6-18 years, and for girls aged 6-16 years. Boys weighed and measured number 3,214, girls 2,557. Both sexes were measured bare-footed, and weighed without footwear, and wearing light clothing only. In many pupils it was difficult to determine the correct age, but certainty was reached in the great majority. Tables of heights and weights, age and sex specific, are given, and graphs of these measurements are presented. While our Swazi children are on the 25th percentile of the Boston scale, their heights and weights compare favourably with those of British and Cape Coloured children. Growth, i.e. increase in height and weight, occurs in spurts, and is most marked about the time of puberty. The findings of the present survey are compared with those of other observers.

b) The menarche in Swazi girls was found to occur at an average age of 13 years 8 months; this was calculated from observations on 383 girls. This landmark corresponds roughly with the onset of menses in British and American girls.

c) Tuberculin testing was carried out in over 3,000 pupils in the third year of the service; 2,903 tests were read. A Heaf apparatus and PPD was used for the tests; results were read after one week. Of the 2,903 pupils, 48% were tuberculin positive. Positive reactors were 49% in boys, and 46% in girls. Results are given in tabular form and as graphs. The results compare well with those obtained by a WHO team in 1956/57; the percentage positives is also on a par with those of young people in the United Kingdom. Tuberculosis is a serious problem in Swaziland, and large scale BCG vaccination is necessary.

4. General Sickness Statistics. Of the general population, 45.4% were found to be unhealthy over 3 years; 41% of boys and 49% of girls were unhealthy. The incidence of anaemia, defective vision, ear, nose and throat diseases, respiratory diseases, malnutrition and skin diseases is presented for each year, for pupils of both sexes. Percentages are given for the incidence of these diseases in sick pupils and in all pupils. A table of the average annual incidence of these diseases is also presented. The diseases are ranked, and the order of precedence is surprisingly constant over three years. On an average :-

26.3% of pupils (boys 21.7%: girls 30.6%) are anaemic:
11.4% of pupils (boys and girls not calculated separately) have defective vision:
6.3% of pupils (boys 5.5%: girls 7.2%) have ear, nose and throat diseases:
2.9% of pupils (boys 3.6%: girls 2.2%) have respiratory disease:
1.8% of pupils (boys 2.6%: girls 1.1%) have malnutrition:
1.6% of pupils (boys 2.1%: girls 1.1%) have skin diseases:
25.5% of pupils (boys 24.7%: girls 25.1%) are undernourished.

Graphs are given to illustrate the above findings.

5. Different Diseases in Detail.

a) Anaemia. This was the commonest disease encountered. Diagnosis was clinical only in 1961, and checked by haemoglobin estimations in 1962 and '63. The Talquist method was used. Comparison of results obtained by the Talquist method with those obtained by the Sahli method showed satisfactory agreement. Average haemoglobin in 1,680 pupils was 68% Talquist; average haemoglobin in 172 pupils was 68% Sahli (9.5G). Only 12% of children had a haemoglobin below 60%. Tables are given showing the age/sex specific distribution of anaemia; this information is also given in graph form. There is no statistically significant difference between the incidence of anaemia in boys and girls.

In 172 children who reported for full investigation of anaemia, blood smears showed normocytic normochromic and normocytic hypochromic anaemia in over 88%; macrocytic and dimorphic anaemia accounted for over 11%. Urine microscopy of these pupils showed 7% of them to be bilharzia positive.

The high incidence of anaemia in a population not heavily parasitized and in whom the iron intake is apparently adequate, is contrary to the findings of practically all other observers, whose findings and opinions are quoted where applicable. The problem encountered here needs much further investigation.

b) Nutritional Status. The Majority of our children were eating a basic Swazi diet. The staple foods were maize products, with occasional meat and vegetables. This was supplemented by "European" foods taken as extra, such as bread, biscuits, and tinned fish. The Swazi diet is deficient in protein, fat-soluble vitamins, vitamin B complex, and calories. Most of our children had something to eat before they went to school; they had their main meal in the evening, with very little to eat in between. Undernutrition, i.e. a child 10% or more below the average height/weight for its age, was found in 25% of the pupils; just under 25% of the boys and just over 25% of the girls were undernourished. Seven percent of all pupils were 20% or more below their average age/sex specific heights and weights. Undernutrition therefore, exists on a large scale.

Undernutrition is distinguished from malnutrition, the latter being regarded as a qualitative deficiency, and is present in just under 2% of children. It is seen chiefly as a vitamin B complex dificiency, presenting most frequently as a malnutritional cheilitis. Other observers do not separate undernutrition and malnutrition; thus their findings cannot be compared with those of the present series.

Undernutrition and anaemia occur together frequently in both boys and girls; 41% of undernourished boys and 62% of undernourished girls are also anaemic. Of all pupils, 51.5% are undernourished as well as anaemic. The differences between the incidence of anaemia in all pupils and in undernourished pupils are statistically significant, though no valid explanation can at present be offered. It is postulated that both the undernutrition and the anaemia have a common etiological factor, which could well be a deficiency of protein.

c) Errors of Vision. The average incidence of errors of vision over 3 years was 11.4%. At the school pupils were tested with the standard Snellens chart. Illiterate Es and animal test charts were of no use for testing these children. Vision of 6/6 or better in an eye regarded as normal. At the hospital, complete eye examination was followed by a repeat Snellen test, and then Jaeger types were used for near vision, type 3(D$\pm$ 1.00) being regarded as normal. Eye diseases accounted for 5.2% of defective vision, while 94.8% of visual defect was due to errors of refraction. 5,541 pupils were tested at the schools, 73 at the hospital. Of the 73 who had a complete eye test, 85% were found to be myopic, 2.9% hypermetropic, and 11.4% had pure astigmatism. Compared with London and Edinburgh schoolchildren (defective vision in 25% and 23% respectively) our Swazi children have a low incidence of visual defect. However, the incidence of myopia in our pupils is disproportionately high, compared with British children; this needs further investigation.

d) Diseases of the Ear, Nose and Throat. These account for 6.8% of ill health in Swazi schoolchildren. 54% of cases had tonsillitis with or without lymphadenitis, 31% had cervical lymphadenitis with or without other ear, nose and throat diseases, and 14% had purulent rhinitis. Otitis media, a good indicator of the severity and chronicity of upper respiratory infections, is very rare. Upper respiratory

infections must, therefore, be regarded as mild and seasonal in these children.

e) Heart Disease. Only 22 cases were found, 16 in boys and 6 in girls. Nine cases were considered rheumatic in origin, ten showed cardiomegaly without apparent cause, and the remainder were regarded as congenital heart disease.

f) Musculoskeletal Diseases. In three years, 23 pupils with orthopaedic disease were seen; 15 boys and 8 girls. Only one case could be ascribed to trauma.

g) Mentally Sub-normal. Seven pupils were diagnosed mentally sub-normal, all boys. One boy was an idiot, the other six were less severely retarded.

h) Skin Diseases. These were found in 1.6% of all pupils; boys were more commonly affected than girls. 62.6% of skin diseases in both sexes were fungus infections, 13.7% were scabies and 7.6% pyodermias. Rarer diseases accounted for 16%. The standard of personal hygiene in these pupils appears to be good in the light of these figures.

i) Umbilical Hernia. 179 cases were seen in both sexes, an incidence of 2.3%. The sex ratio was male/female : 3/5. Over 28% of hernias seen in both sexes were "new" hernias, which developed between the annual medical examinations. Both umbilical and paraumbilical hernias were seen, which finding contradicts textbook statements that the true umbilical hernia occurs in infancy only, and that paraumbilical hernia is confined to adults.

j) Goitre. Swaziland is a goitre area; the cause is lack of iodine. A special lookout was kept for cases of goitre. Thyroid enlargement was very common in pubescent girls, but only three frank goitres were seen in three years. All were colloid goitres, and all three occurred in pubescent girls.

k) School Leavers. Of the 7,848 pupils of both sexes examined over three years, 1,340 or 17% left school. The reasons for this are for the most part obscure. Of the school leavers, 48.3% were unhealthy, while of the school attenders 45.4% were unhealthy. These differences are not statistically significant, and it is not known what part ill health played in the decision to leave school. However, nearly half the children ended their school careers suffering from some disease or other, and would probably be handicapped by ill health in whatever they attempted to do subsequently.

6. Prophylactic Inoculations.

a) Smallpox Vaccination. This was offered in 1962 and '63. 1,007 pupils were vaccinated in 1962; of these 334 were first vaccinations and 673 revaccinations; in 1963 361 primary vaccinations (84% successful) were done, and 64 revaccinations.

b) TAB vaccine. In 1963, two injection of TAB vaccine were offered to each pupil. Enteric fever accounted for over 2% of all hospital admissions in Swaziland in 1963, and protection is thus essential. 3,103 first injections were given, and 2,793 second injections.

c) BCG Vaccine and Oral Poliomyelitis Vaccine. Both were scheduled to be given in 1964, but our medical work was terminated at the end of 1963.

7. Conclusions. Our School Health Service suffered from certain obvious limitations. Shortage of staff caused all the work to devolve on one doctor; financial stringency precluded a really comprehensive service; distance between schools wasted much time on travelling; the "newness" of the Service and lack of previous efforts in this direction forced on to do little more than basic work; Swazi traditionalism caused resistance and hampered our efforts. In spite of these limitations the Service progressed and became more comprehensive from one year to the next.

The health of schoolchildren in Swaziland leaves much to be desired. With an overall incidence of ill health of 45%, anaemia and sub-nutrition are the chief problems, followed by defective vision. These three major causes of ill health are easily and completely remediable. The school health service should become nationwide, but a receptive community should first be created by extensive and intensive health education.

Recommendations would be :-

a) A countrywide, official School Health Service, employing enough doctors and nurses to ensure efficiency. An annual medical examination of all schoolchildren should be done.

b) Preventive measures should be energetically applied in the first two school years, among others tuberculin testing, BCG vaccination, small-pox vaccination, TAB injections, and poliomylitis vaccination.

c) Every school should have its own dairy herd and vegetable garden, in order to provide a wholesome, balanced school meal for every pupil once a day. Teachers and pupils themselves should be made responsible for gardens and livestock, and periodic free Government agricultural and veterinary inspection should be carried out.

d) Health education, including basic nutrition, should be brought to the whole community, i.e. teachers, pupils and parents.

New facts brought out by this Survey are :-

Age/sex specific height and weight standards have been established; the onset of the menarche in Swazi girls has been determined; the incidence of different diseases in the schoolchildren has been worked out; the heavy incidence of anaemia and undernutrition in these children has been

demonstrated, and myopia has been shown to be the commonest cause of defective vision.

Finally, this School Health Service, started by a mission hospital, pointed out to the Government Authorities the great need for such a Service on a permanent basis; it is hoped that our pioneering effort will bear lasting fruit in Swaziland.

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VI. BIBLIOGRAPHY

Perusal of the literature in connection with this thesis has of necessity been very wide; it extended over almost four years. Of the several hundred books, reports and journals read, surprisingly few contained information applicable to the problems which I encountered. I have therefore, decided to list only those publications which have been useful in providing background information, or which deal more specifically with points made in this thesis.

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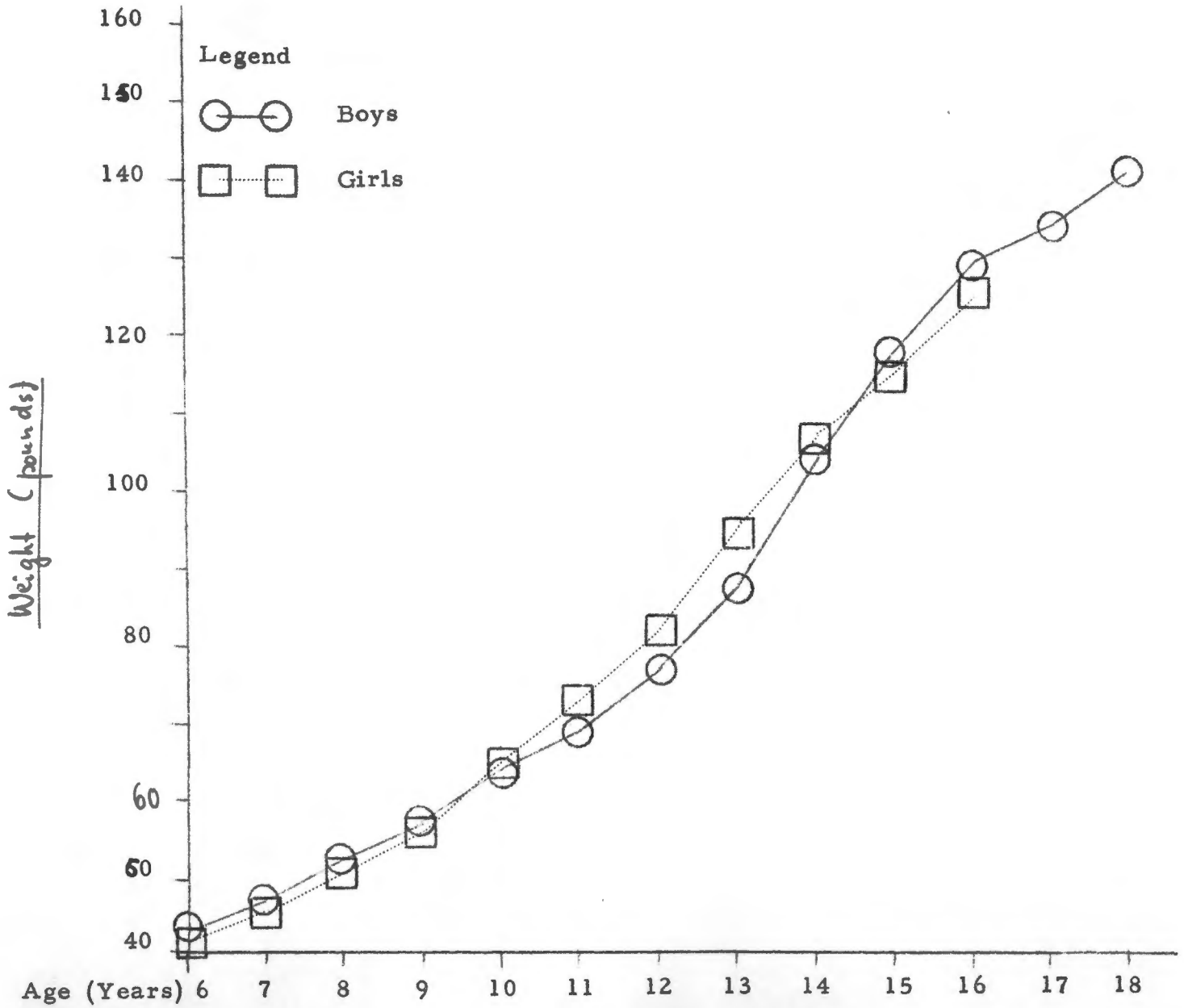

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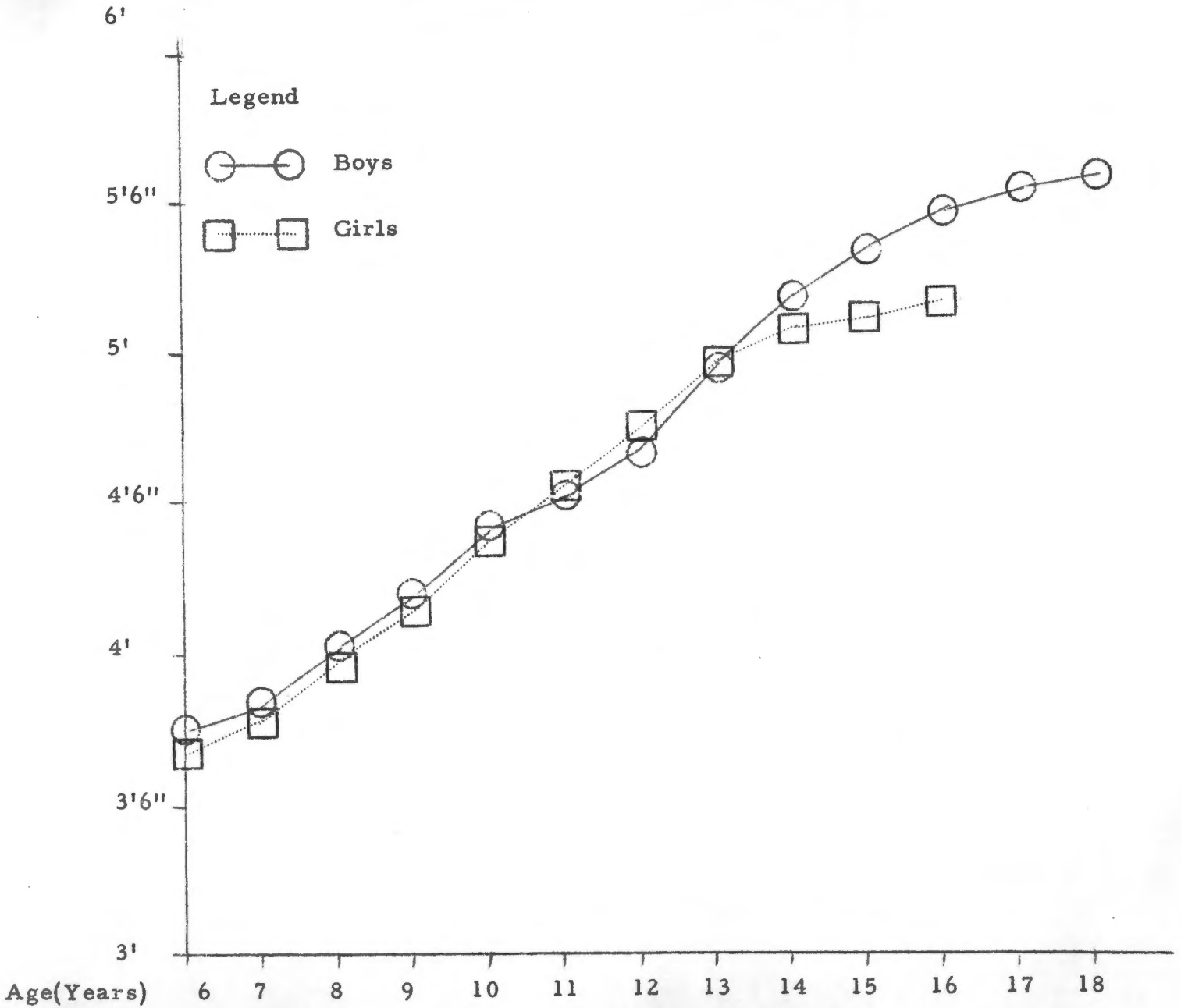

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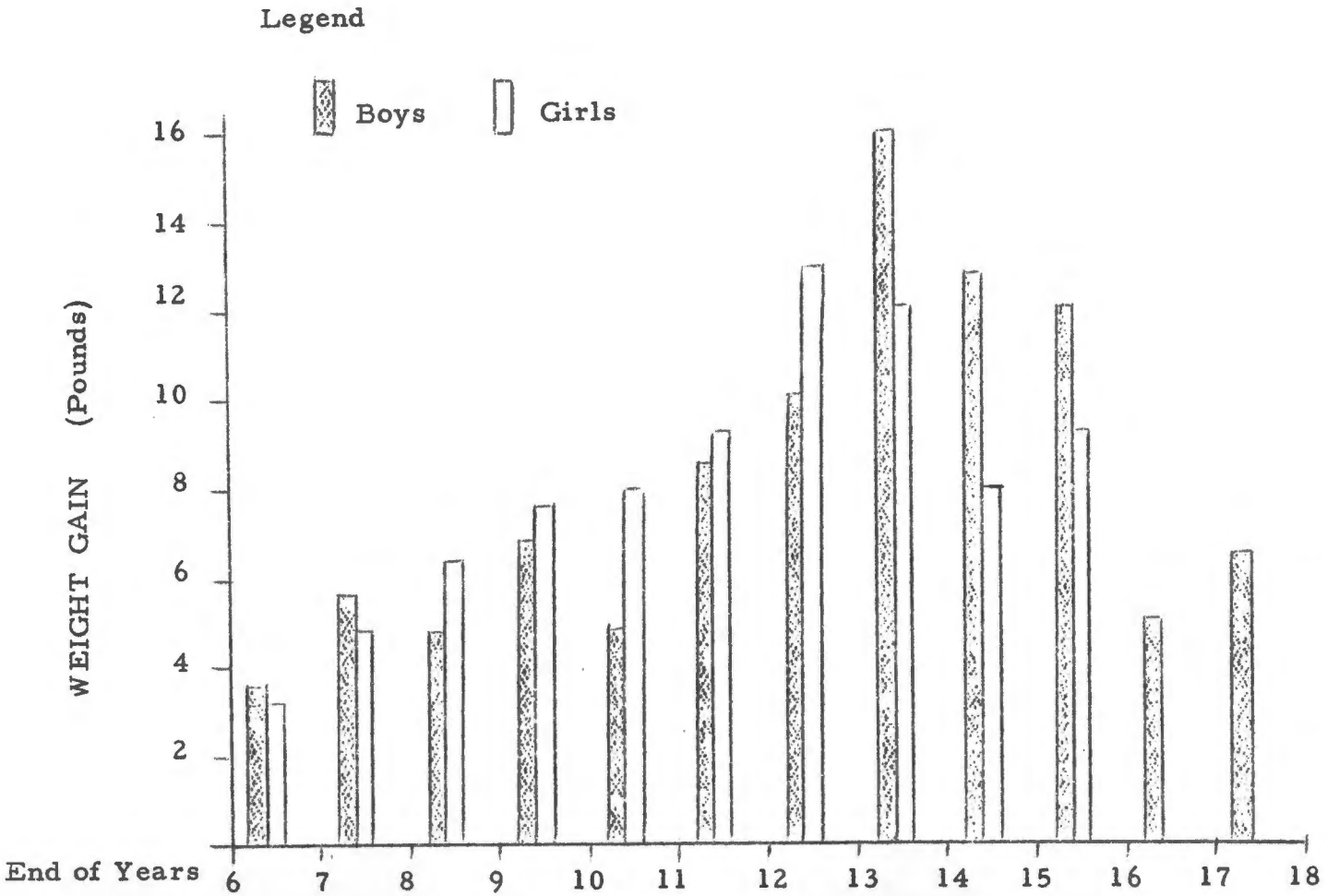

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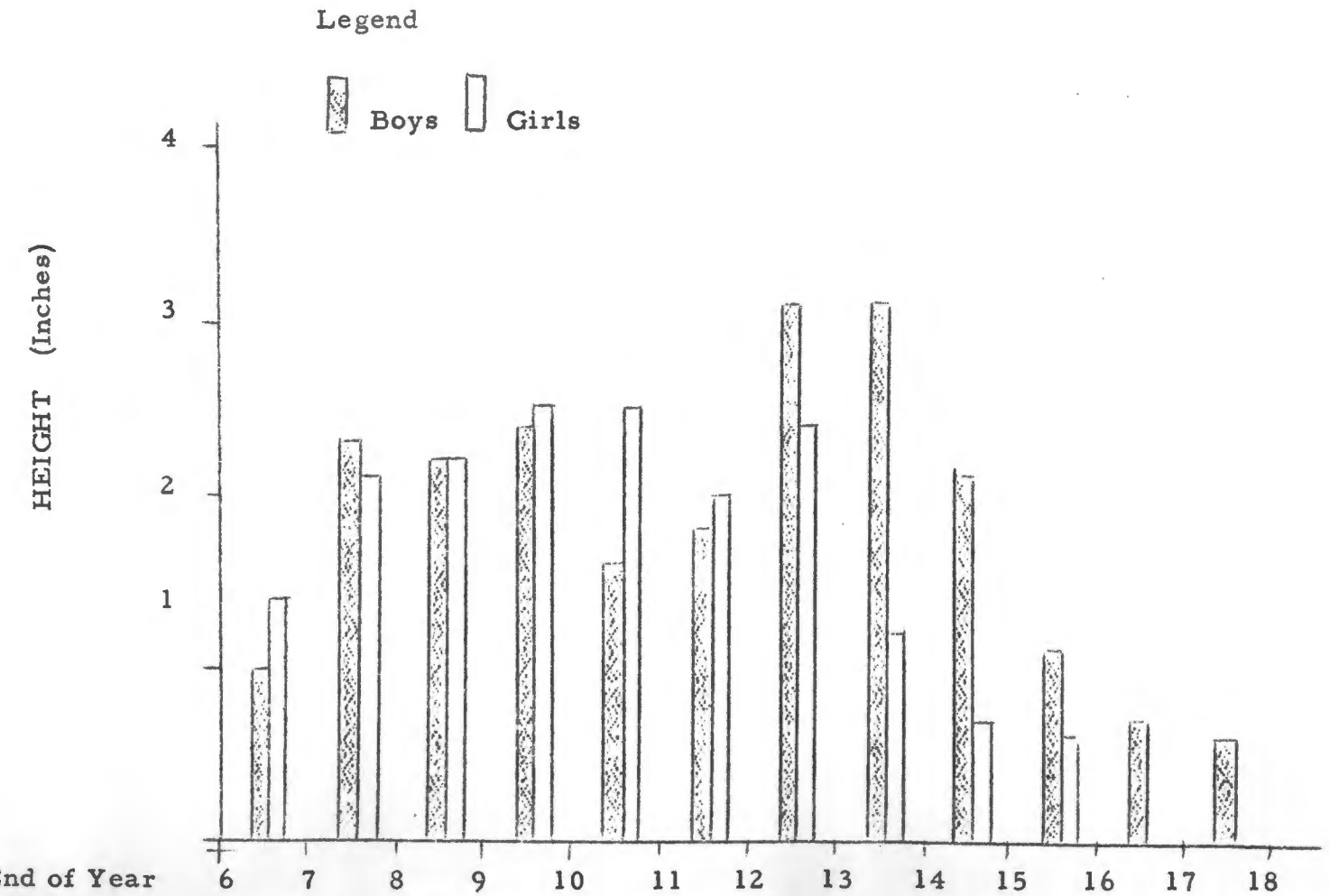

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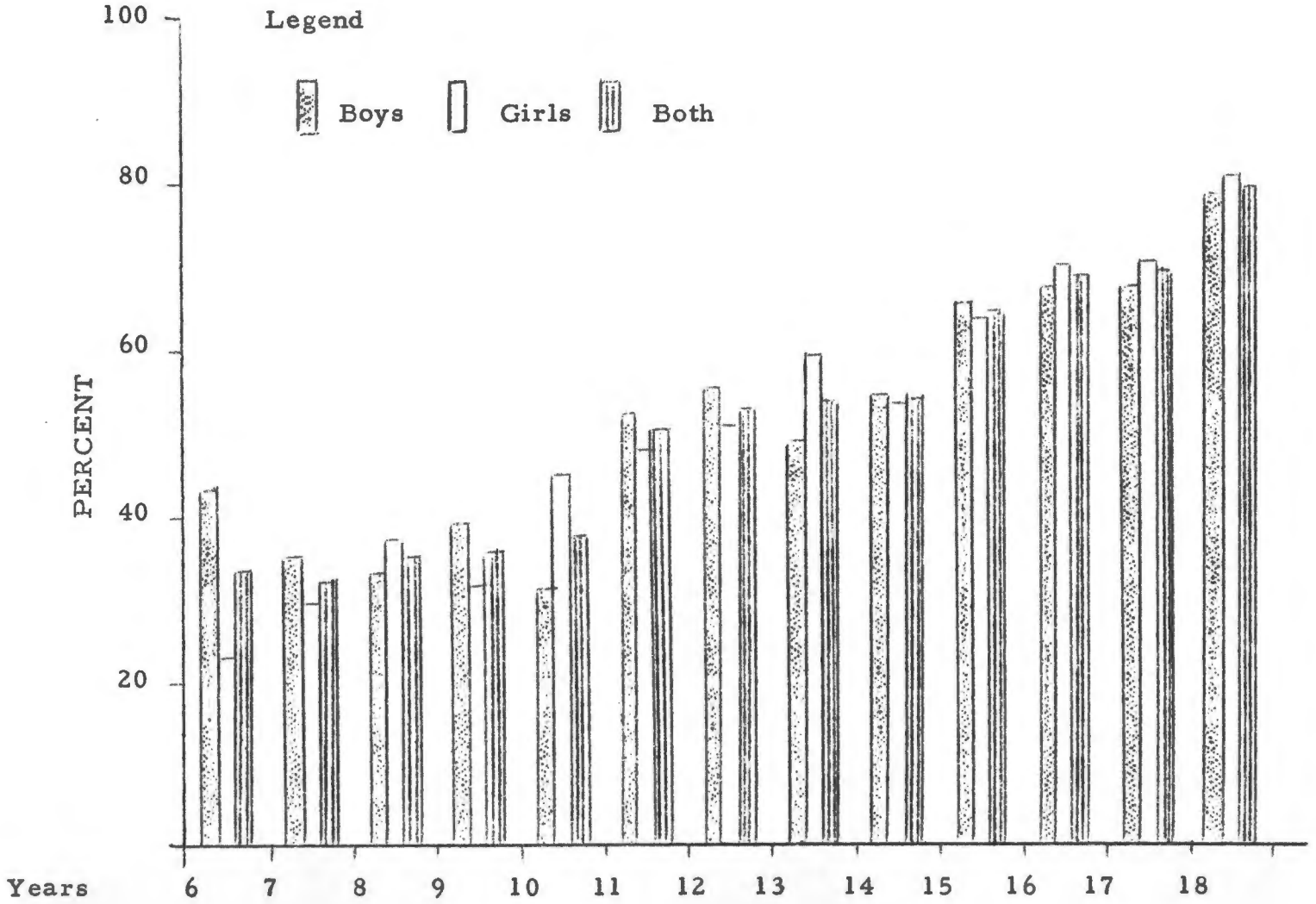
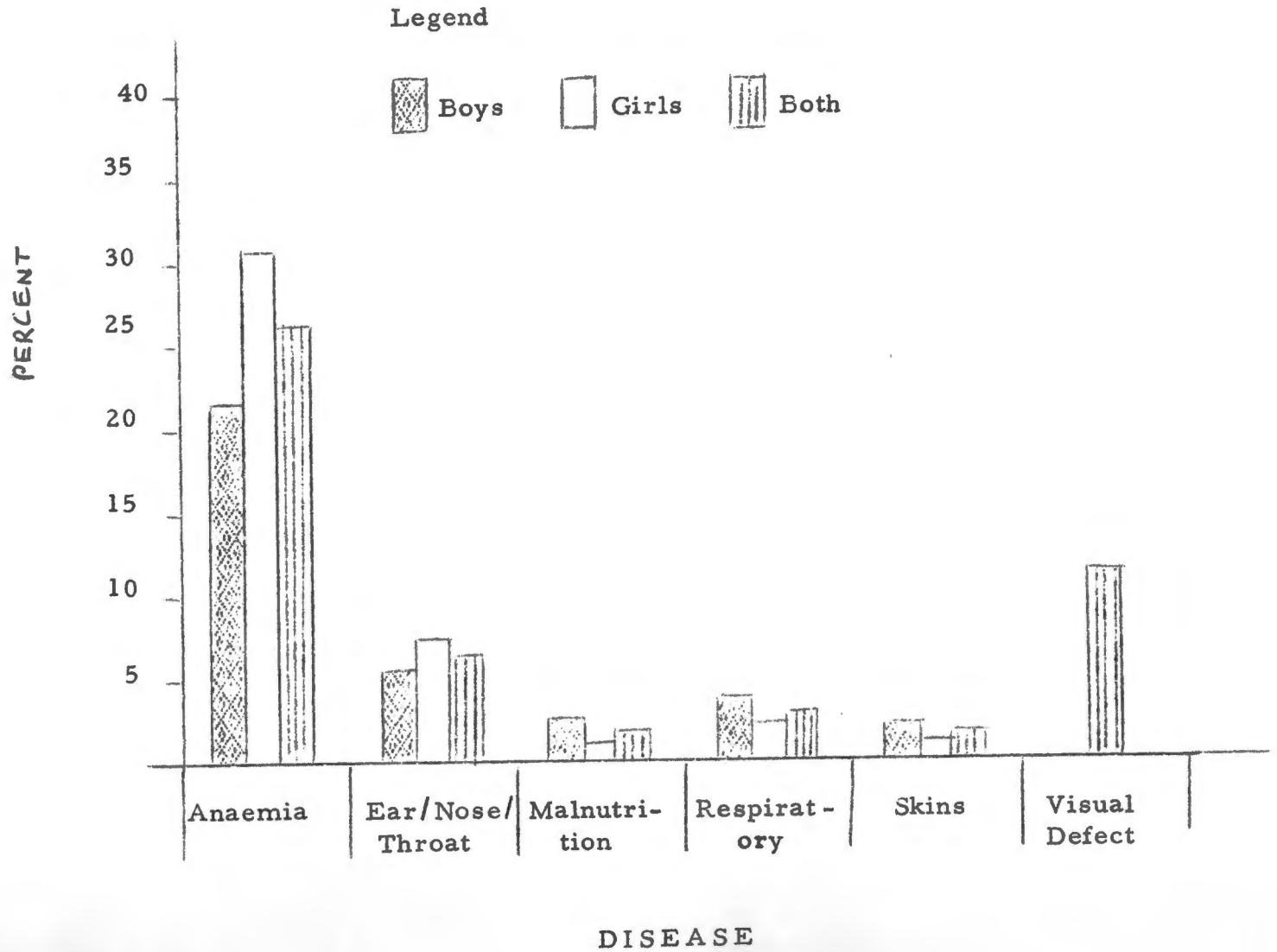


PERCENTAGE INCIDENCE OF DISEASES IN SWAZI CHILDREN (4)

THREE YEAR AVERAGE



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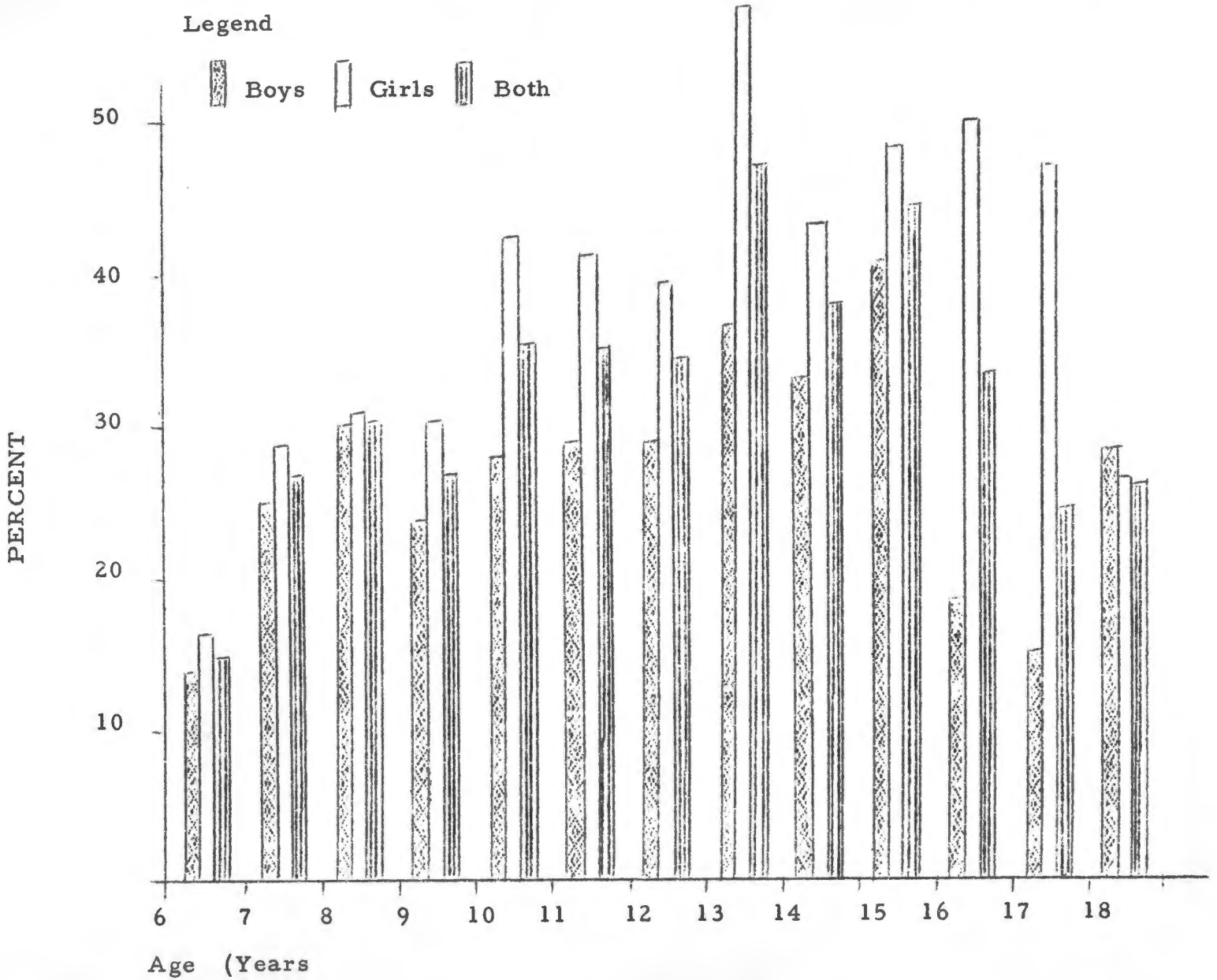

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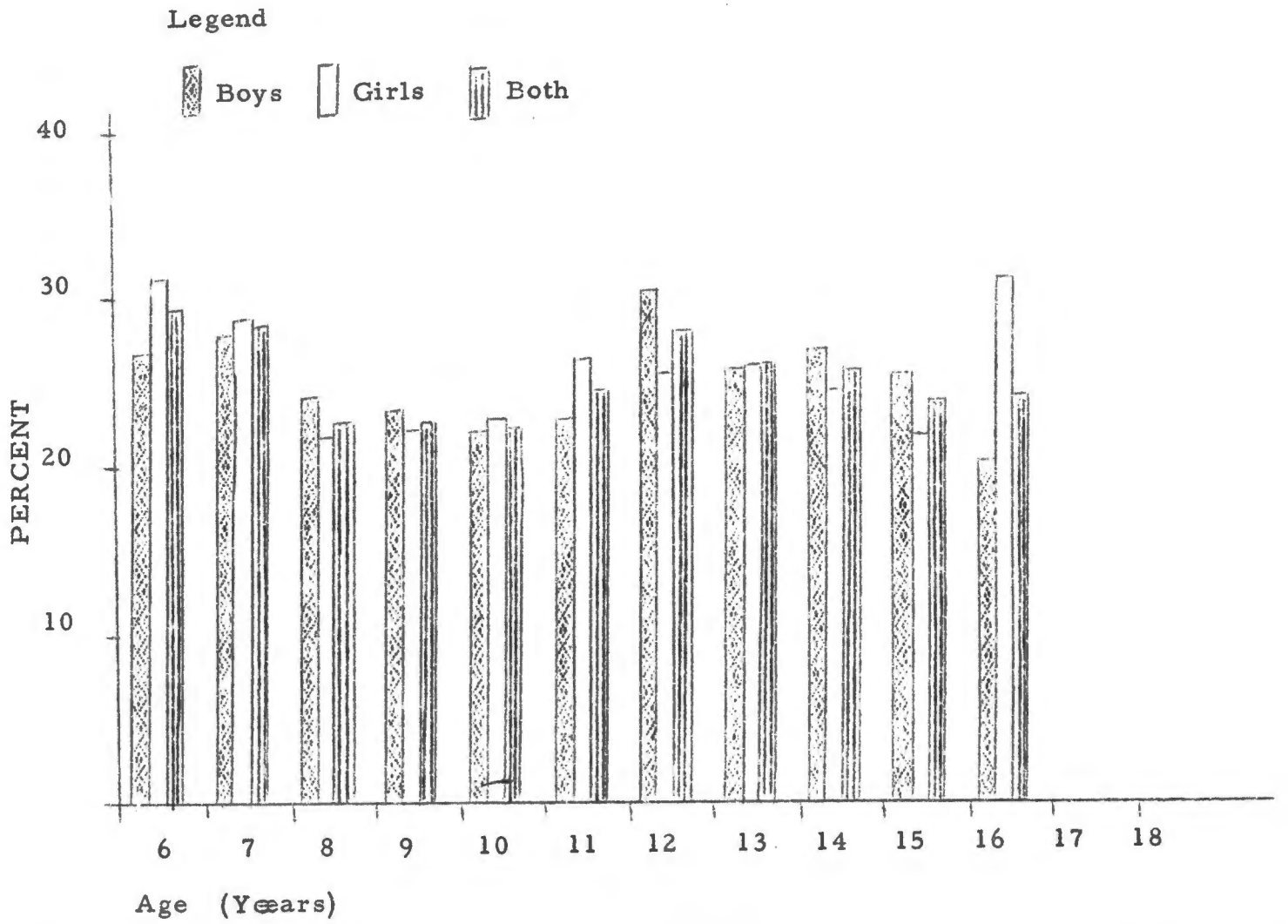

PERCENTAGE INCIDENCE OF ANAEMIA & UNDERNUTRITION and ANAEMIA IN UNDERNOURISHED CHILDREN

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